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Construction Methods

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June, 1936

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Construction Methods

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330 West 42nd St., New York

ROBERT K. TOMLIN, Editor — JUNE 1936 — WILLARD CHEVALIER, Vice-President

Editorial Staff: Vincent B. Smith, John B. Huttl (San Francisco)
Leonard H. Church (Cleveland), Nelle Fitzgerald

Current Jobs

Buildings

Public — In the field of public building construction the major awards during the last month included: A $1,109,000 public school in Brooklyn, N. Y., to the **H-R-H Construction Co.**, of New York City. Superstructure of Jane Addams housing project, in Chicago, to **S. N. Nielsen Co.**, of Chicago, for $1,334,650. Superstructure for auditorium in Fort Worth, Texas, to **R. F. Ball Construction Co.**, of Fort Worth, for $322,303. Also in Fort Worth, **James T. Taylor** obtained a $459,089 contract for a coliseum superstructure. At Canandaigua, N. Y., **Irwin & Leighton**, of Philadelphia, bid in Veterans Administration buildings at $903,400. A school building in Ruston, La., went to **Caldwell Bros. & Hart**, of New Orleans, for $421,249. To **H. Mayson**, of Los Angeles, a 2-story school building at Pasadena, Calif., was awarded on a bid of $588,845.

Commercial — A $1,000,000 apartment house contract in White Plains, N. Y., was obtained by **Chas. T. Wills, Inc.**, of New York City. **Teaneck Builders, Inc.** are constructing at Teaneck, N. J., a 140-house project at a cost exceeding $1,000,000. A hotel in Williamsburg, Va., is being built under a $750,000 contract by **John Lowry, Inc.**, of New York City. In Washington, D. C., a motion picture theater is being built at a cost of $500,000 by **Associated Construction, Inc.**, of Philadelphia. General contract for 31 two-story, duplex houses in University City, Mo., to cost $500,000, was awarded to **Oliver Kraehe & C. F. Vatterott**, of St. Louis.

One of the big jobs of the month was 32-story office building at Rockefeller Center, New York City, awarded to **Todd & Brown, Inc.**, of New York City, for approximately $3,500,000.

Industrial — A $1,500,000 oil refinery is being built for the Standard Oil Co., at Olean, N. Y., by the **Lummus Co.**, of New York City. At Bradford, Pa., **M. W. Kellogg Co.**, of New York City, is handling a $1,200,000 project for the Kendall Refining Co. The Grand Rapids (Mich.) Varnish Co. has given the **Barnes Bros. Construction Co.**, of Grand Rapids, a $630,000 contract for a factory building. **Ridge Construction Co.**, of Rochester, N. Y., is building for the Eastman Kodak Co., of that city, lens and paper manufacturing buildings costing $877,000. At Pittsburgh, a $1,500,000 steel sheet mill for the Jones & Laughlin Steel Corp., is being built by **Merritt-Chapman & Scott Corp.**, of New York City, and **Jerome A. Utley**, of Detroit.

Highways

Among major highway construction awards have been the following: **Lane Construction Corp.**, Meriden, Conn., $238,146, for 3.4 mi. of reinforced concrete in Smithfield and Glocester, R. I. In Minnesota, paving contracts have been awarded to **W. W. Magee**, of St. Paul, for $245,816 and **Okes Construction Co.**, of St. Paul for $234,192. **D'Onfro Construction Co.**, of Albany, N. Y., bid low with a total of $900,013, for bridges on the Henry Hudson Parkway in Bronx County, N. Y.

The State Highway Commission of New Mexico has awarded a grade crossing project at Albuquerque, to **W. E. Bondurant**, of Roswell, N. M., for $304,045. In California, the highway tunnel on the approach to the Golden Gate Bridge in Marin County went to **T. E. Connolly**, of San Francisco, for $587,918. The **Macco Construction Co.**, of Clearwater, Calif., obtained a $770,205 contract for 3.4 mi. of highway leading to the Golden Gate Bridge, San Francisco. **William F. Bowe, Jr.**, of Augusta, Ga., bid in for $204,938, 11.9 mi. of concrete paving in North Carolina. In Kansas, for 8.7 mi. of state highway earthwork and culvert, **M. Wunderlich**, Jefferson City, Mo., was successful bidder at $222,132. A $264,447 contract for 13.8 mi. of concrete paving in Austin County, Texas, was obtained by the **Harrison Engineering Construction Co.**, of Kansas City, Mo. The Arizona Highway Department let a $244,610 contract for 15 mi. of surfacing, to **O. F. Fisher**, of Phoenix. **Victor Olson Construction Co.**, of Youngstown, Ohio, obtained a $251,836 state highway contract, in Trumbull County.

Bridges

A number of bridges and grade crossing elimination structures were placed under contract last month. For a bridge over Lake Champlain, between Rouses Point, N. Y. and Alburg, Vt., **Andrew Weston Co.**, of Woodmere, N. Y., received a $422,429 contract. A $140,000 grade crossing job for the New York Central R.R. at Gates, N. Y. went to the **Walsh Construction Co.**, of Syracuse, N. Y. New York State Highway Department bridge awards included a 65-ft. girder structure near Oxford to **D. W. Winkelman Co.**, of Syracuse, at $109,887; a 105-ft. girder bridge near Whitney Point to **Richard Hopkins Co.**, Albany, for $117,546; and a 114-ft. girder bridge near Duanesburg to **Foley Bros.**, New York City, at $132,029.

In Missouri, the State Highway Commission awarded to the **Wisconsin Bridge & Iron Co.**, of Chicago, a $535,703 contract for an 11-span, 2,000-ft. steel truss viaduct with concrete floor over the Blue River in Kansas City. **Hoffman Construction Co.**, of Portland, Ore., was low with a bid of $410,212, for a railroad viaduct in Milbrook County, Oregon. The **Holmes Construction Co.**, of Wooster, Ohio, received from the Pennsylvania Highway Department a $369,402 award for a plate-girder and reinforced-concrete bridge in Mahoning Township. In Chicago, for the steel superstructure of the Randolph St. viaduct, the bid of $281,777, from the **Joseph T. Ryerson & Son, Inc.**, of Chicago, was successful. The **Rue Construction Co.**, of Fargo, N. D., and **Megarry Bros.**, of Bismarck, N. D., obtained from the state highway department a $263,938 contract for an interstate bridge over the Red River at Fargo. A bid of $236,939 obtained for the **W. E. McHugh Co.**, of Cleveland, state highway contract for a plate-girder bridge at Bedford, Ohio. At Liberal, Kansas, the **Pittsburgh-Des Moines Steel Co.**, of Des Moines, Iowa, bid in for $200,000, an 1,800-ft. steel pile trestle to carry gas mains across the Cimarron River. The Missisquoi Bay bridge in Vermont went to **Caputo Construction Co.**, of Brighton, Mass., for $373,871.

Unclassified

For building 4 airplane hangars at Hickman Field, in Hawaii, **A. W. Quist Co.**, of Seattle, received contract for $1,415,000. The ventilating building for the Mid-Town Hudson tunnel in New York, went to **G. Siegler**, of Jersey City, N. J., for $526,516. Construction of an esplanade along the East River Drive, New York City, has been begun by **Del Balso Construction Co.**, of New York, under a $984,158 contract.

AND WHO'S DOING THEM

How—

... For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

How ... ARC WELDING repaired corroded eye-bars in lower chords of 50-year-old bridge over railroad. — p. 27
How ... MOVABLE FALSEWORK, on wheels, carried new bridge to place in halves. — p. 30
How ... TEMPORARY TRACK CHANGES were carefully planned for railway operation during bridge replacement. — p. 33
How ... INTERNAL VIBRATION by finishing machine attachment consolidated pavement concrete. — p. 35
How ... BITUMINOUS SURFACING for highway was prepared in mobile concrete mixer. — p. 35
How ... THIN ALUMINUM FOIL, facing air space, insulated walls of house. — p. 36
How ... CARPENTERS erected metal-clad members of flame-proof frame for house. — p. 37
How ... TWO PAVING MIXERS, operating side by side, increased progress on concrete base construction. — p. 40
How ... CALCIUM CHLORIDE, added to concrete mix, speeded setting and finishing in cool weather. — p. 40
How ... STEEL-PLATE TEMPLETS and long manual screed helped build rolled lip curb. — p. 42
How ... DOWEL BAR SPOTTER simplified steel placing at joints in concrete pavement base. — p. 41
How ... RESERVE STORAGE TANK kept asphalt filler warm for delivery to kettles on brick paving. — p. 43
How ... LARGE DRILL JUMBO, carrying 19 machines, was rigged on chassis of old power shovel in tunnel. — p. 44
How ... IMPROVED STEEL STRUT simplified separation of pavement slabs to form safety island. — p. 44
How ... STREET LIGHTING STANDARDS were made safe, in event of short circuits, by grounding. — p. 44
How ... SWIVEL-PIPE SPRINKLER on tank truck wet burlap for curing concrete pavement. — p. 44
How ... CABLE STRINGING RIG regulated tension in conductor of long transmission line. — p. 45
How ... BITUMINOUS SPRAY cured concrete lining on sides and bottom of canal. — p. 45
How ... HARD FACING was applied to valve seat. — p. 45
How ... BELT CONVEYOR elevated concrete, delivered by truck, to hopper on wall scaffold. — p. 46
How ... REMOVABLE CHUTE SECTIONS made concrete delivery from tower hopper to scaffold levels more flexible. — p. 47
How ... SAFE COFFERDAM HEIGHTS may be determined by plotting flood frequencies on chart. — p. 50
How ... CLAY MAT formed seal over rock-fill cofferdam and timber mats protected clay from wave wash. — p. 52
How ... CONTINUOUS TIMBER FRAMING, lowered into water, formed Ohio River type of cofferdam. — p. 54
How ... CRIB COFFERDAM was designed with special provisions for overtopping by floods. — p. 54

Current Jobs

AND WHO'S DOING THEM

Wear Out or *Rust Out?*

In part 6 of their series of articles on "Planning and Plant for Heavy Construction", which appeared in the May issue of this journal, Messrs. Ackerman and Locher make one point that is well recognized by every successful contractor. It is the importance of getting the most out of equipment, of driving it to capacity even at the risk of shortening its life in terms of years.

This does not mean, of course, that equipment should be driven without proper care or maintenance or that it should be so *over*loaded that breakdowns are chronic with corresponding loss of time and costly repair bills. But it does mean that sound economy requires an operating rate as nearly as possible at full capacity, thereby getting the most out of the plant in its youth. With the continuous improvement in plant, most equipment soon reaches a point of diminishing returns where, even though the machine may still be in working order, it becomes economical to replace it. Whenever a contractor should consider such a replacement in order to realize more efficient operation, he will be the more willing and content to proceed boldly with the desirable change, if he knows that he already has had an ample output from his old equipment. Then he can write off the cost of the new machine out of the aggregate savings he has realized from the old one.

The authors quote one contractor as saying, "I have always worked on the principle that it is better to wear out the equipment rather than let it rust out." Another recently expressed the same principle to this writer in an observation that every piece of plant has a certain "cream-life" and that his policy is to "skim the cream" so that, as improved plant becomes available, he can afford to write off the old and keep his productive capacity at an efficient maximum.

Years ago another successful contractor expressed this in his oft-repeated maxim that "a lagging job is a losing job." He always was as keenly interested in the daily ratio of his "plant operating hours" to total job hours as he was in his actual output. Still another, a superintendent of the old school, working in a day when jobs were smaller and could be kept under his eye, could identify the peculiar racket made by each item of his plant; whatever he might be doing in the office-shack he could detect instantly the silence of any one of them and would be out in a jiffy to find out why it had shut down.

All this, of course, expresses the same principle: get so much out of your equipment every day that by the time better equipment is available you will know that the old has paid for itself and can be retired without loss. Today it is especially necessary that plant should be kept at its highest pitch of production for several reasons: the modern contractor has a much larger investment in mechanical plant than did his forebears; the obsolescence of equipment is so much more rapid that he must "skim the cream" as soon as possible; the constantly increasing refinement of engineering design requires the use of the more refined plant; unit costs must be figured so closely as to require operation on a factory "production" basis; the various construction operations are so interdependent that if any particular one lags, it interferes with so many more that the aggregate loss is immense; the human element on any job is very likely to reflect the tempo and consistent performance of the mechanical plant. These are but a few of the reasons why today it is more essential than ever to drive plant for all it is worth.

The practice of "coddling" equipment for any reason whatever, is reminiscent of the dear old ladies of another age who so carefully conserved their very best gowns in order that they might have them "to be laid out in."

A similar attitude toward construction equipment may well speed the day when a contractor will be "laid out," but whether the carefully nursed equipment will be equally available as a shroud is something else again.

Willard Chevalier

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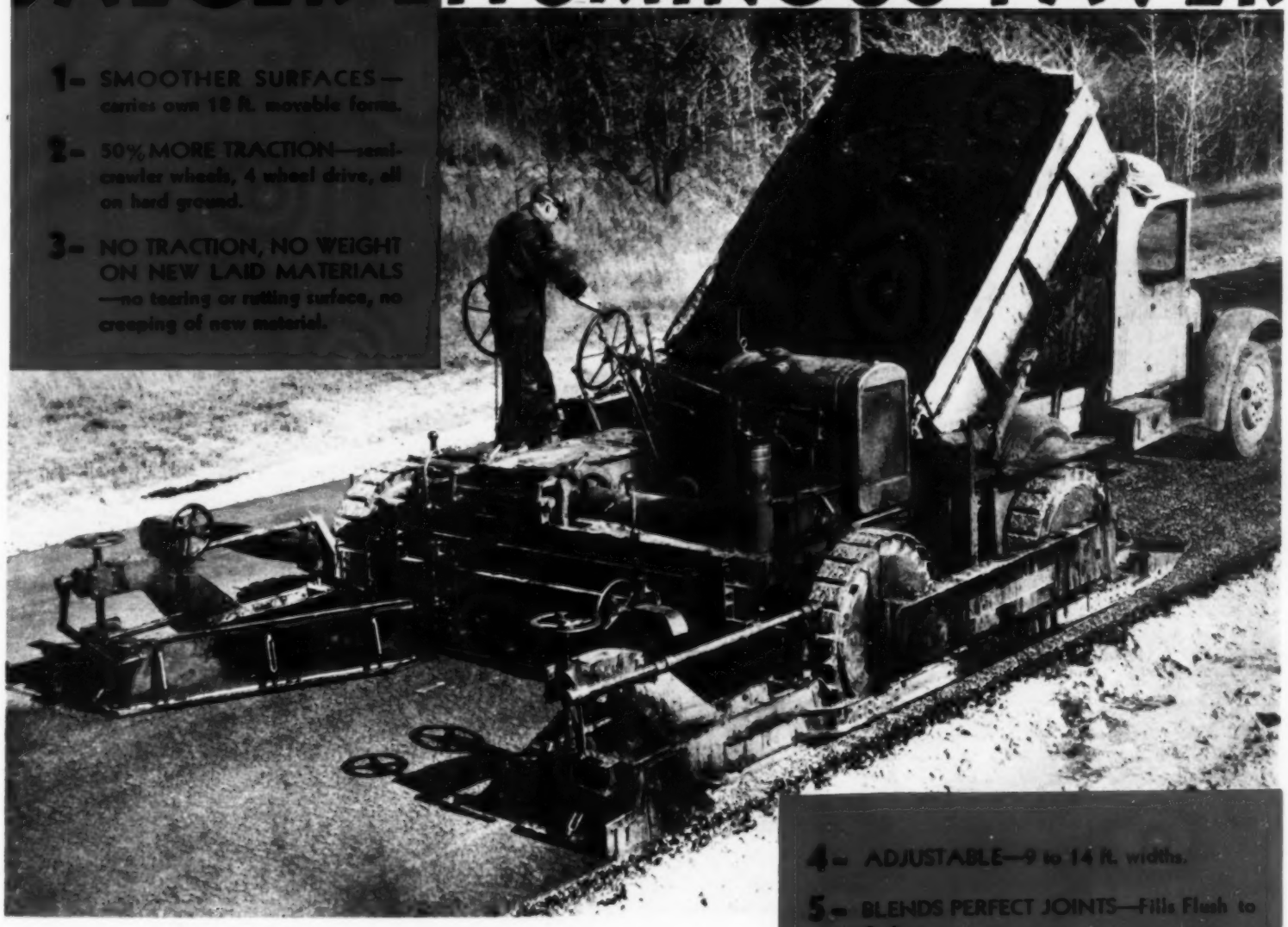

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7– LAYS HOT OR COLD BITUMINOUS, STONE OR MACADAM.

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9– CUTS COSTS—less hand finishing, bigger capacity, one man control.

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Yesterday's methods just can't compete with the Jaeger Bituminous Paver for speed, for smoothness of the surface, or for saving handwork back of the machine.

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Tandem Pavers--1500 Tons a Day !

Check the 10 practical advantages found in no other paver. They'll show you why road-builders are pensioning off their older equipment and paying for Jaegers with the first new job.

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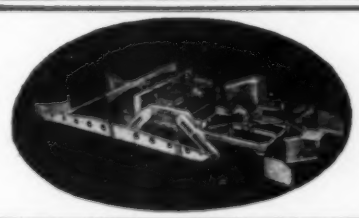

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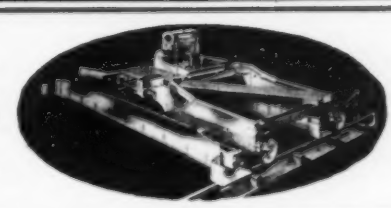
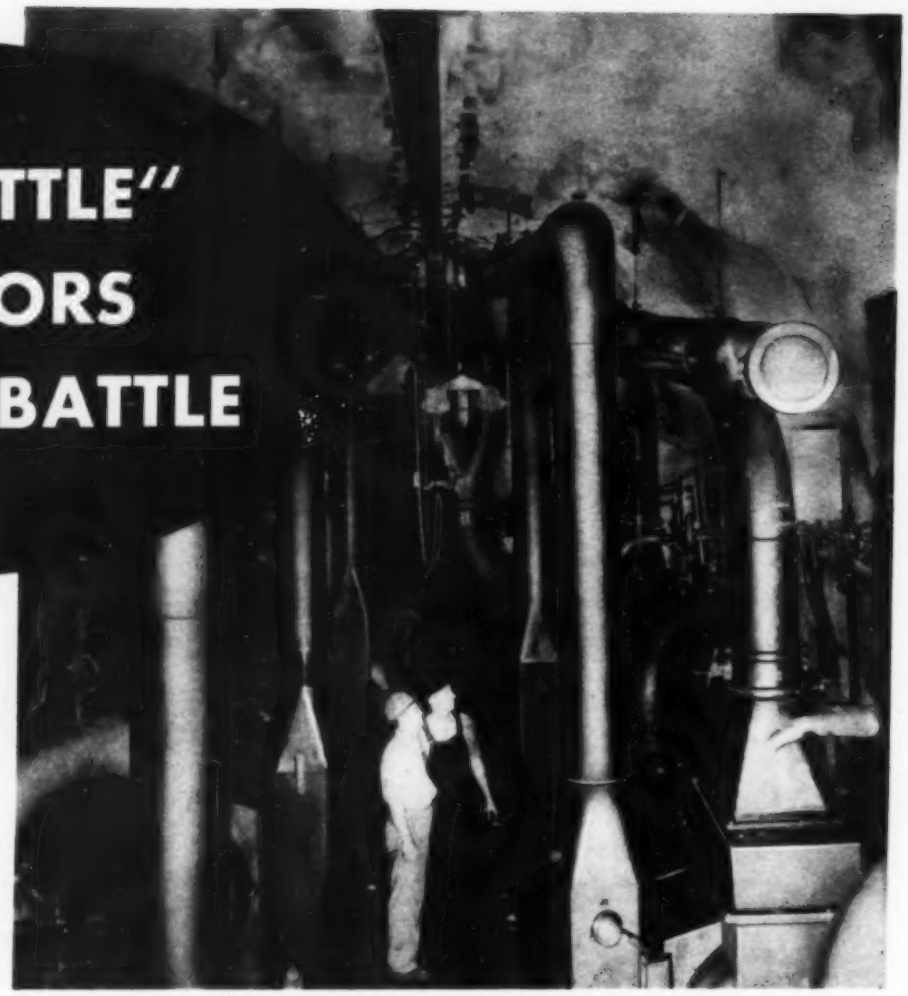
AUTOMATIC FINISHERS
for Highest Type Concrete and Bituminous



ONE "BOTTLE" OF MOTORS WINS THE BATTLE



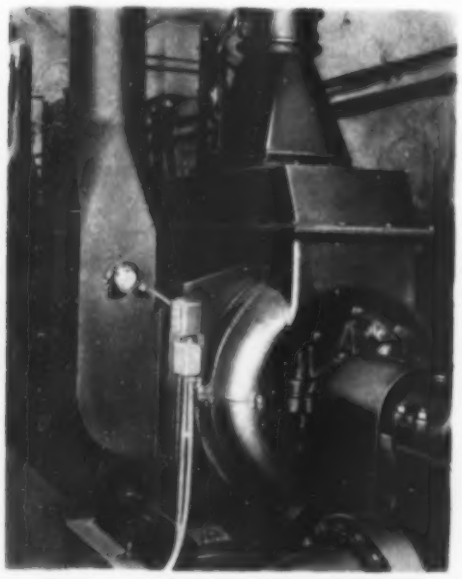
In this bottle-shaped cavern G-E motors direct-connected to pumps, will operate weeks on end without inspection—even if the tunnel is completely flooded

"AND THEN I tried a bottle of 700-horsepower General Electric motors."

If the 800-foot Potrero shaft on the San Jacinto Tunnel could speak, it might have given this testimonial. The San Jacinto is the 13-mile tunnel on the 242-mile aqueduct of the Metropolitan Water District of Southern California which will bring water to thirteen cities, including Los Angeles. As months stretched into years, water was balking all efforts to make satisfactory progress in construction of the tunnel. Twice the shaft was flooded. Sand and mud repeatedly buried the equipment.

Faced With Disgrace

"Every time I was fitted out with pumping equipment considered adequate, another flood burst on me and the whole battle of dewatering and reconditioning had to be renewed. Dewatering took weeks and weeks with ordinary small sinker pumps. I was faced with the disgrace of holding up the entire $220,000,000 project!



One of four G-E totally enclosed pump motors which helped win battle against elements at Potrero shaft of San Jacinto Tunnel

"Then the engineers had a wonderful idea. Why not put the pumping equipment in a bottle—a bottle which would withstand 800 feet of water pressure? Then, if water came in faster than it could be pumped out, the cork could be put into the bottle and the pumps could keep right on working, no matter how high the water rose.

"The bottle was cut from solid granite, away from the tunnel, at the bottom of the shaft. In effect, it lies on its side, connected by its neck to the tunnel. The bottle is 95 feet long, 19 feet wide, and 22 feet high. The entrance is now sealed off with a plug of reinforced concrete 16 feet thick. Through this plug, the neck of the bottle extends, 4½ feet square. The cork' is a gasketed steel door.

G-E Motors to the Rescue!

"Five big 4-stage centrifugal pumps are in this bottle, each driven by a General Electric 700-horsepower, totally enclosed, forced-air-ventilated motor. The entire pumping station can be operated from the surface, where General Electric control panels are located.

A Complete Cure

"The capacity of the station is 15,000 gallons per minute against a total head of more than 800 feet, and although at times it has been loaded nearly to full capacity, it has never failed. Yes, sir, since taking one bottle of General Electric motors, I have had no more trouble!"

YOU GET SPEED FOR THE JOB, MORE SERVICE FOR YOUR MONEY, WHEN YOU BUY G-E EQUIPMENT

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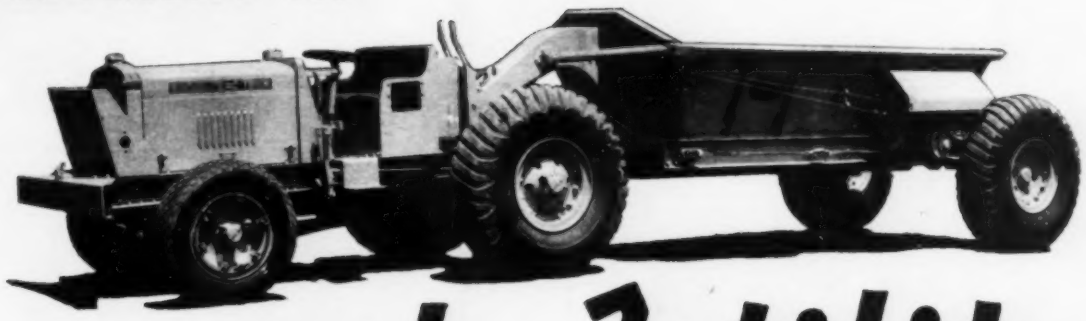
AN INVESTMENT IN



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Hauling Heavy Loads over Soft Ground

Big tire traction—correct distribution of load with less dead weight—enable Trac-Truks to do more work by maintaining greater speeds on the runways, faster travel in spongy borrow pits and over soft fills with better flotation of heavy loads.

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A wide range of selective gears and travel speeds are available in Trac-Truks which, with the aid of big tire flotation, move large capacity loads—much faster in higher gears, with planetary final drive, in notable comparison to the ability of ordinary equipment.

Easy Short Turning with Exclusive Steering Brakes

Trac-Truks are built for quicker action on the straightaway and turning movements in and out when loading under a shovel or elevating grader. Their exclusive steering brakes are a big advantage in slippery going, making of sharp pivot turns.

No "Time Out" for Dumping

There is no stopping, backing and wasting of time in placing the load with Trac-Truks. The dumping is done instantly while on the move and closing the doors is automatic with the Euclid marvelously smooth operating wheel wind.

Faster Dirt Moving with Greater Capacity

With upwards of eight yards of pay dirt per trip—yardage builds up rapidly and unit costs go down accordingly. The extra production gained with Trac-Truk greater capacity adds up to a pleasing and profitable total at the end of the day and completion of the job.

Built for Performance with Lasting Endurance

Trac-Truks are the result of well balanced design in power, traction, capacity and distribution of weight and are ruggedly built to withstand normal use and service of heavy duty hauling requirements with lasting satisfaction.

WHERE TRAC-TRUKS HAVE PROVED THEIR VERSATILE UTILITY—FOR LONG OR SHORT HAULS ON THE NATION'S BIGGEST JOBS

Mid-West Public Works

The building of Clear Creek Reservoir, Ft. Smith, Ark., constructing Sullivan Dam in Colorado, and the Sutherland and Columbus power projects in Nebraska are a few of the many jobs that bear witness of Trac-Truk reputation for moving dirt at lower cost.

T. V. A.

This large fleet of Government owned Trac-Truks are doing wonderful work in satisfying the discriminating demands of federal engineers.

Dam Construction

A fine example of popular preference for Trac-Truks is the purchase and use by George Brewster, Bogota, N. J., of nineteen Trac-Truks on the mammoth Mohawk Ohio Dam.

All-American Canal

Where Trac-Truks prove their great efficiency in fast dirt moving over long hauls ranging up to two and one-third miles one way.

Cape Cod Canal

With a grueling test made of the first Trac-Truk purchased, this fleet has grown to nine units as the result of acknowledged preference by a most exacting contractor.

Mississippi Levee

Embankments galore along the Mississippi stand as landmarks in attesting to Trac-Truk hauling efficiency and low cost results in levee work.

Iowa Railroad

Edward Peterson Company, Omaha contractor, was recently awarded the Burlington Railroad job and immediately eight Trac-Truks were selected and put to work to move more than a million yards.

★ *The present day position of high rank won by Trac-Truks and national prestige gained, have been accomplished over a relatively short period of time, which is significant in attesting to their outstanding quality and performance merit. Write for the further details required in accordance with your equipment needs and job conditions.*

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45% of all Lorains shipped in the last 15 months have gone to work as draglines, clamshells and cranes—an ever-increasing percentage as more and more contractors discover these facts about Lorains—

CAPACITIES—10 models, ranging from the L-95 (at top, 2 yd. bucket on 70 ft. boom) to the ⅜ yd. L-27. *A capacity and type for every job.*

MOUNTINGS—2 speed, long, wide crawlers for all models. Crawler extensions and wide treads available for lower ground pressures. Locomotive crane carbodies available for L-77 and 75D; motor truck mountings for L-40-30 models. *A type for every job and ground condition.*

BOOMS—Built of high tensile alloy steel. Center sections and straight or gooseneck tip extensions available. *A length and type for every job.*

CONVERTIBILITY—Every Lorain (except L-95) is convertible to shovel—capacities, 2 yd. to ⅜ yd. —Backdiggers and Skimmer Scoops available. *A type of suitable boom for any future job.*

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Damage Risks Reduced

BECAUSE 'Incor' cures or hardens in one-fifth the time required by ordinary Portland cement, concreting costs are lowered, better concrete results. Reduced damage risks are an important added advantage. To illustrate:

Dam constructed by Roesser & Pendleton, Inc., oil operators, on Clear Fork of Brazos River, near Lueders, Texas (shown below) was built in three sections. 'Incor', used on exposed sections, was service-strong in 24 hours, safe against sudden water rise days sooner than ordinary concrete. Also, by speeding completion, 'Incor' minimized bad-weather shut-downs.

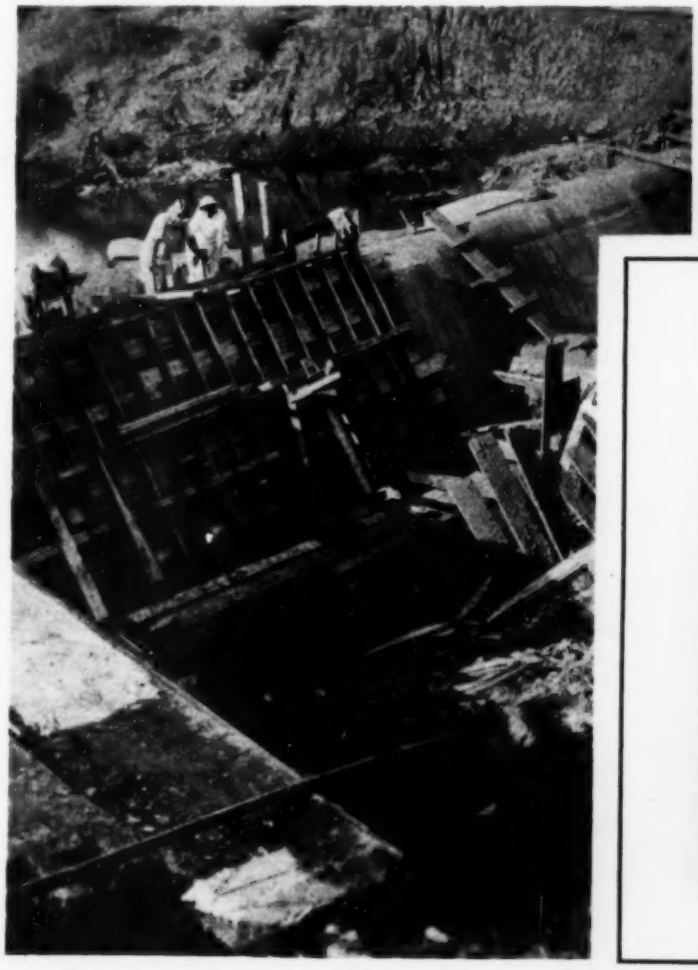
Proximity Print Works (right), Greensboro, N. C., erected a new warehouse next to railroad siding. 'Incor', used in foundation to offset cave-in danger, was self-supporting in a fraction of the usual time.

In concrete-frame construction, 'Incor' saves money by eliminating non-productive time—that is, the "dead" days when work on the frame stops while ordinary concrete cures.

And 'Incor' makes stronger, denser, more watertight concrete, by curing *thoroughly* in the short time concrete can be kept wet on the average job.

'Incor'* is made and sold by producers of Lone Star Cement, subsidiaries of International Cement Corporation, New York.

* Reg. U.S. Pat. Off.



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"Furfural" is a new refining material. When oil is treated with Furfural, a stronger film is produced . . . a film that *resists heat in hot cylinders.* It is called the "Furfural'd Film."

A "Furfural'd Film" is *all lubricant.* All tar and gum forming elements . . . and other non-lubricating materials . . . have been removed. There are no waste products to gum and stick piston rings . . . or to form hard carbon . . . sludge . . .

This oil lasts longer because the oil film provides a greater — more complete — protection for the moving parts of the engine.

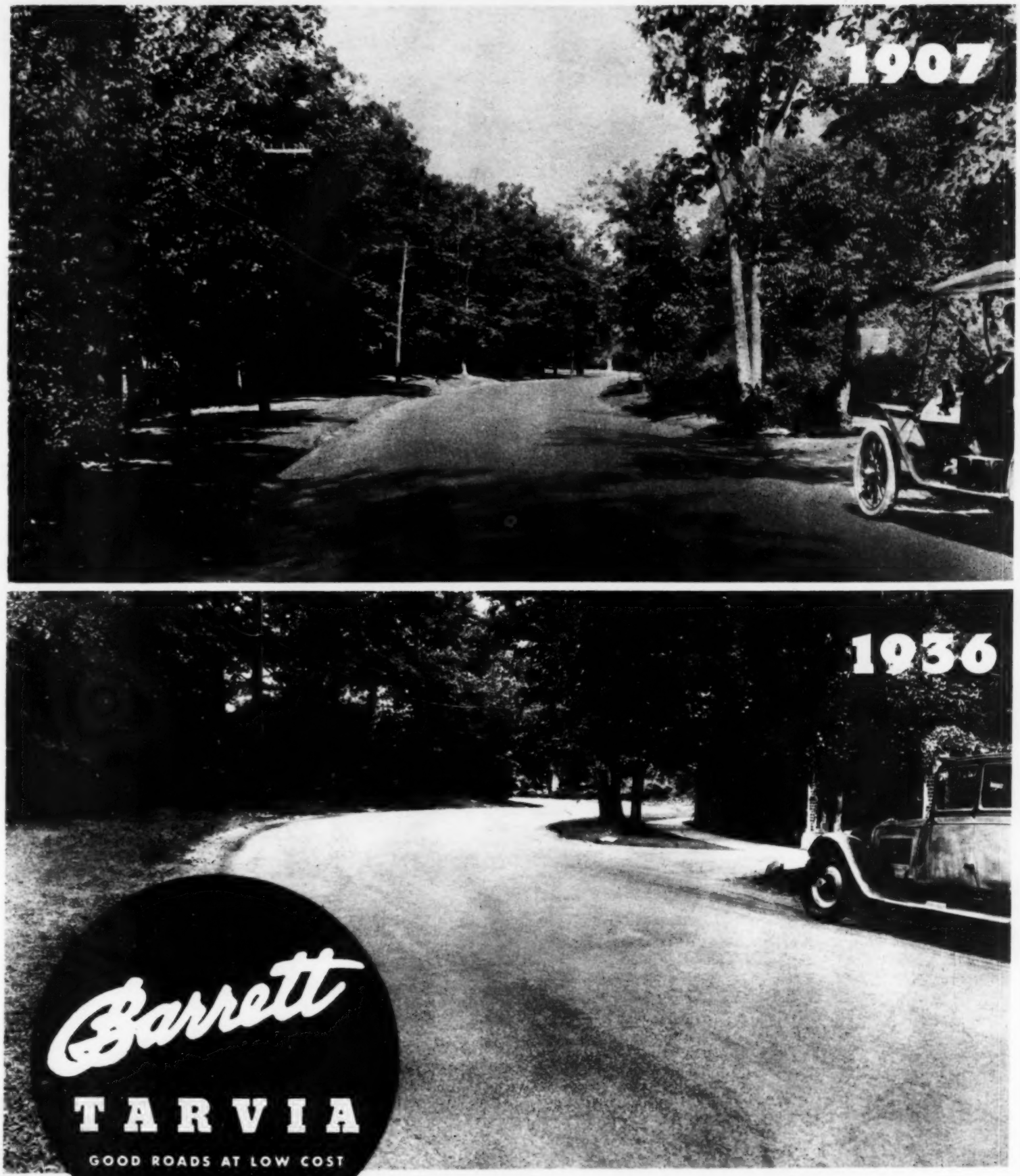
It lubricates so completely that wear on cylinder walls, piston rings and bearings is almost eliminated. Greater piston seal is assured. Hence, more complete combustion . . . higher fuel economy.

A Texaco representative will be glad to provide practical engineering service to prove economies you can get with the New Texaco Motor Oil.

THE TEXAS COMPANY
135 East 42nd Street New York City
Nation-wide distribution facilities assure prompt delivery

New TEXACO MOTOR OIL

Sheridan Road, Hubbard's Woods, Winnetka, Illinois. Tarvia since 1907.



The clumsy, old automobiles—with their oil lamps, "balloon" tops and high pressure tires—that chugged along Sheridan Road in 1907 were scrapped long ago. But the Tarvia pavement is just as satisfactory—smooth, easy-riding and skid-safe—today as it was 29 years ago. Proof, indeed, that Tarvia roads "can take it," and such service records are not exceptional—for Tarvia!

THE TECHNICAL SERVICE BUREAU of The Barrett Company invites your consultation with its technically trained staff, without cost or obligation. Address The Technical Service Bureau, The Barrett Company, 40 Rector Street, New York.

THE BARRETT COMPANY New York Chicago Birmingham Philadelphia Boston St. Louis Cleveland Minneapolis Lebanon Milwaukee Detroit Baltimore Columbus Youngstown Toledo Buffalo Providence Syracuse Hartford Cincinnati Bethlehem Rochester Portland, Me. Norwood, N. Y. In Canada: THE BARRETT COMPANY, LTD. Montreal Toronto Winnipeg Vancouver

The MODERN TREND in MATERIAL HANDLING

Barber-Greene Stackers have greatly widened the scope of belt conveyor applications — bringing belt conveyor economy and convenience to jobs that previously required much more expensive, or less effective equipment.

In setting a new pace in the maneuverability of large conveyors, Barber-Greene Stackers have established a new standard for the cost of handling large quantities of material.

Ingenious B-G design has made every Barber-Greene Stacker an engineering achievement—exactly adapted to its own peculiar application.

When you have large quantities of material to pile, inaccessible points to reach, or any material handling problem where long overhang, high capacity and perfect flexibility combined would be the solution—communicate with Barber-Greene. Take advantage of belt conveyor economy, and Barber-Greene ingenuity. Phone, write, or wire.

Barber-Greene Co.,
530 West Park Ave.,
Aurora, Illinois.

35-17

Via Barber-Greene STACKERS

B-G Stacker mounted on two sets of R. R. trucks for storing material received from self-unloading boats. Boom 135' long.

B-G Stacker stacking excavated earth at Fort Peck. Machine is crawler mounted, power propelled. Boom swivels under power.

B-G Stacker unloading cars. Crawlers are not only powered, but swivel under power also.

B-G Stacker at Norris Dam. Tail end pivoted. Truck rides on single semi-circular R. R. rail.

B-G Stacker for handling concrete, being assembled in Barber-Greene shop. Boom is 97' long and hinged for raising and lowering. Crawlers powered.

BARBER GREENE

Experienced Road Builders Know Their Superiority

FOR more than 63 years, Austin-Western has built the finest graders for the road-building industry.

Shown above is the current model—embodying the most advanced features. A touch of the hydraulic controls manipulates the blade and other working parts even though tons of earth and pressure resist . . . large diameter circle supports the blade ends—prevents rocking... direct draft transmits tractor power to blade for lowest possible operating costs . . . scientific design permits it to work efficiently in awkward as well as normal positions . . . careful manufacture gives it utmost dependability and a long life of useful service.

Austin-Western builds the most complete line of road-building equipment, including many models of blade graders. Because of the completeness of the line you may rely on Austin-Western men to give impartial advice on the most economical purchase of equipment necessary to your needs.

The Austin-Western Road Machinery Co.

Home Office: Aurora, Ill. Cable Address: AWCO, Aurora

Branches and Warehouses in Principal Cities

Austin-Western

ROAD GRADERS · MOTOR GRADERS · ELEVATING GRADERS · DRAGS
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The Austin-Western Road Machinery Co.
A-6, Aurora, Illinois
Please send details on your No. 8 ☐, 10 ☐, 11 ☐, 12 ☐ Grader.
Name .....
Address 627
City ..... State .....

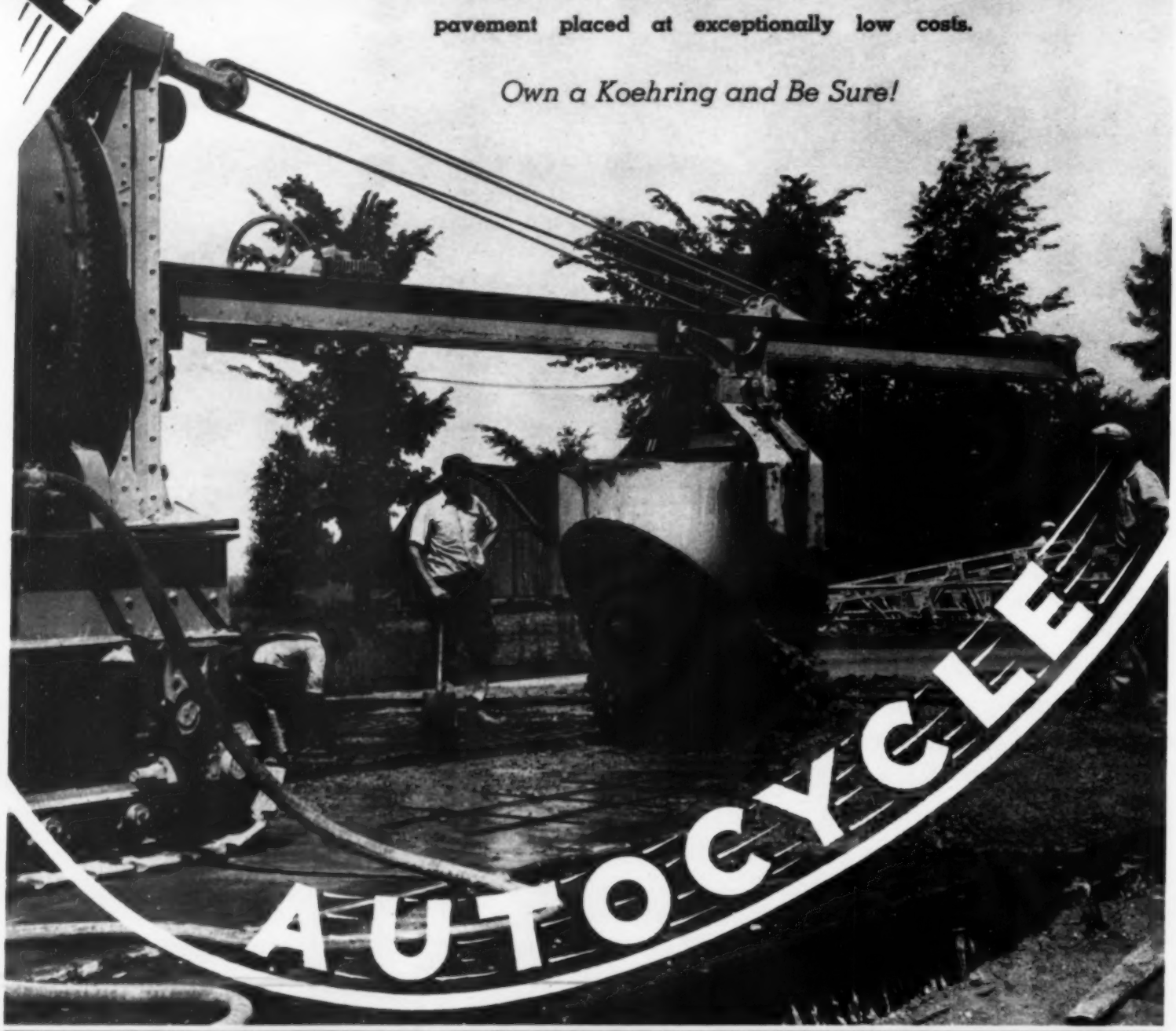
KOEHRING

HEAVY DUTY

STAMINA AND SPEED — A HEAVY DUTY PAVER WITH AUTOCYCLE OPERATION

The Koehring Paver has long been the standard for high speed paving operations. Contractors, owning Koehring Pavers, establish enviable records for pavement placed at exceptionally low costs.

Own a Koehring and Be Sure!



KOEHRING COMPANY

Pavers · Mixers · Shovels · Cranes · Draglines · Dumptors · Mud-Jacks

3026 WEST CONCORDIA AVENUE, MILWAUKEE, WISCONSIN

ON TODAY'S LARGEST RAILROAD PROJECT IN U. S.

GULF QUALITY LUBRICANTS SPEED THE WORK

The Country's largest railroad construction job today is 38 miles in length and will connect the towns of Grundy and Jewell, Va. Gulf fuel and lubricants keep this equipment in continuous operation as it carves out a road bed from the sides of the mountains.

Use of the right Gulf Lubricants keeps all Diesel Equipment in continuous operation

With minimum maintenance expense

KEEP YARDAGE MOVING! That is the command on big projects like this one.

And the men who are charged with the responsibility of keeping Diesel Equipment at top notch efficiency take no chances with lubrication. They use Gulf quality lubricants—the oils that every important Diesel builder in the country has tested and approved.

If friction and wear cause shutdowns, time out for repairs and high maintenance costs for your equipment, ask a Gulf engineer if your lubrication is right. It's more than likely that he can give you helpful suggestions.

"Bulldozers" like this one stand up better in severe service when the right Gulf lubricants protect all moving parts.

GULF INDUSTRIAL LUBRICATION

★ GULF OIL CORPORATION of Pennsylvania

★ GULF REFINING COMPANY

General Offices, Gulf Bldg., Pittsburgh, Pa.

Makers of that Good Gulf

Ask the Boss..

This "Caterpillar" Diesel Tractor hauls big loads from a shovel for a few cents an hour on a coal-stripping operation in Penna.

THEY'LL TELL YOU WHY IT'S FIRST

Quick, easy starting—even in sub-zero weather when other equipment can't be moved . . . sure control and non-skid traction for sharp turns, steep pitches and soft, wet ground . . . no wonder the "Caterpillar" Diesel Tractor is first choice with drivers. Owners choose it for the remarkable cost records that back up its performance . . . earth moved at a few cents per yard . . . bulldozing, scraping, hauling at 60 to 80% reduction in fuel costs . . . maintenance costs at a record low level in spite of hard usage and 24-hour service. It's the power SHOW-DOWN—get the details from a dealer. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

HARD FACTS ON THE SHOW-DOWN:

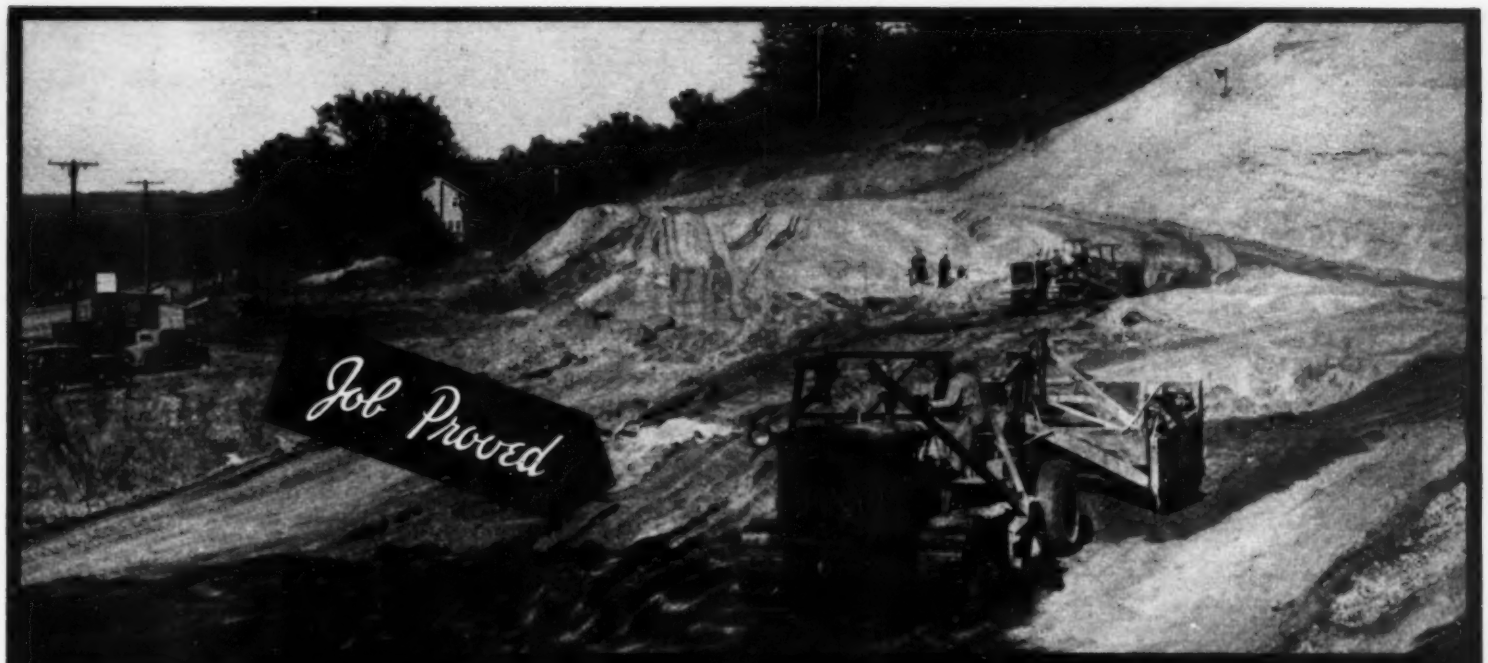
Report from a Massachusetts highway job: "Our 'Caterpillar' Diesel Tractor hauls two 12-yard wagons on a 1200-ft. haul from borrow pit to fill. The average round trip is completed in 12½ minutes, in spite of a 20% grade for part of the trip."

Says a Pennsylvania owner: "Our first six 'Caterpillar' Diesel Tractors have worked more than 8500 hours each and are still setting records for low-cost operation."

CATERPILLAR

REG U. S. PAT OFF

Diesel



981½ HOURS-5,666 LOADS

Two more slices coming off the hillside — The earth boils up into Swords-McDougal's 12-Yard Carryalls.

To move hillsides, Swords-McDougal Company put their faith in Le Tourneau Carryalls, have recently found that faith profitably justified. To cut down on East Peoria (Illinois) hillside, they worked three Le Tourneau 12-Yard Carryalls, a Rooter and Angledozer with "Caterpillar" RD8 tractors, filled the excavated material into a new real estate development. Hauling conditions were decidedly good — 10% down grade for 700 feet — even so, the performance of the Le Tourneau equipment was striking — 5,666 heaping loads in 981½ tractor hours on a round-trip haul that was never less than 4,000 feet, and frequently 4,750 feet.

Fast, steady operation, the result of stout construction and Le Tourneau cable control, made this performance possible, is today increasing profits for hundreds of other Le Tourneau owners the country over.

Ask your "Caterpillar" tractor dealer to show you what Le Tourneau equipment can do for you.

MANUFACTURERS OF:

ANGLEDOZERS, BUGGIES BULLDOZERS, CARRYALL SCRAPERS, CRANES, DRAG SCRAPERS, POWER CONTROL UNITS, ROOTERS, SEMI-TRAILERS.

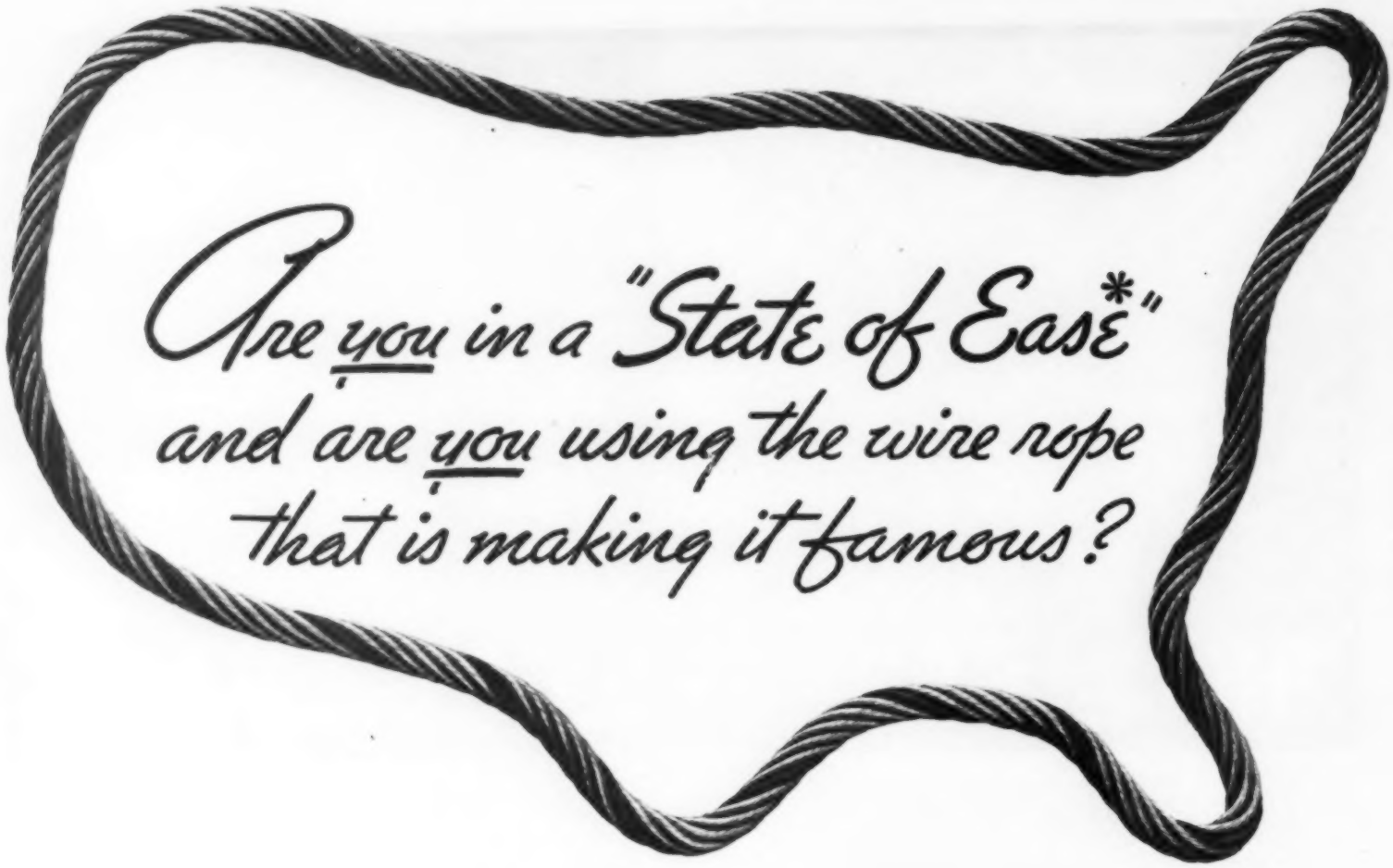
Rolling in high with a heavy load to the fill.

R. G. LeTOURNEAU, INC.

PEORIA, ILLINOIS STOCKTON, CALIFORNIA

Cable Address: "BOBLETORNO"

LETOURNEAU



* The term "State of Ease" is taken from Slocum and Hancock's book "Strength of Materials" which quotes Prof. Karl Pearson: "A body which is free from internal stress is said to be in a STATE OF EASE."

ARE you, as a wire rope user, in a "state of ease"? Are you easy in mind—sure you are getting all that wire rope should give you? Are you using the wire rope that is "free from internal stress"?

TRU-LAY Wire Rope *is* in a "state of ease" because it is preformed. Every wire and strand is free from the unnecessary internal stresses that promote early metallic fatigue.

TRU-LAY has the flexibility that permits bending over sheaves and drums for much longer periods. It has the balanced construction that distributes the load equally to each strand and wire. It offers positive resistance to the kinking, the twisting in sheaves, the poor spooling and other erratic actions that shorten the rope life and pile up needless rope costs. It assures that when outer wires finally wear through they will not stand out to injure men and equipment.

All because every wire and strand in a TRU-LAY Preformed Wire Rope is truly in a STATE OF EASE.

AMERICAN CABLE COMPANY, Inc.
Wilkes-Barre, Pennsylvania
An Associate Company of the American Chain Company, Inc.

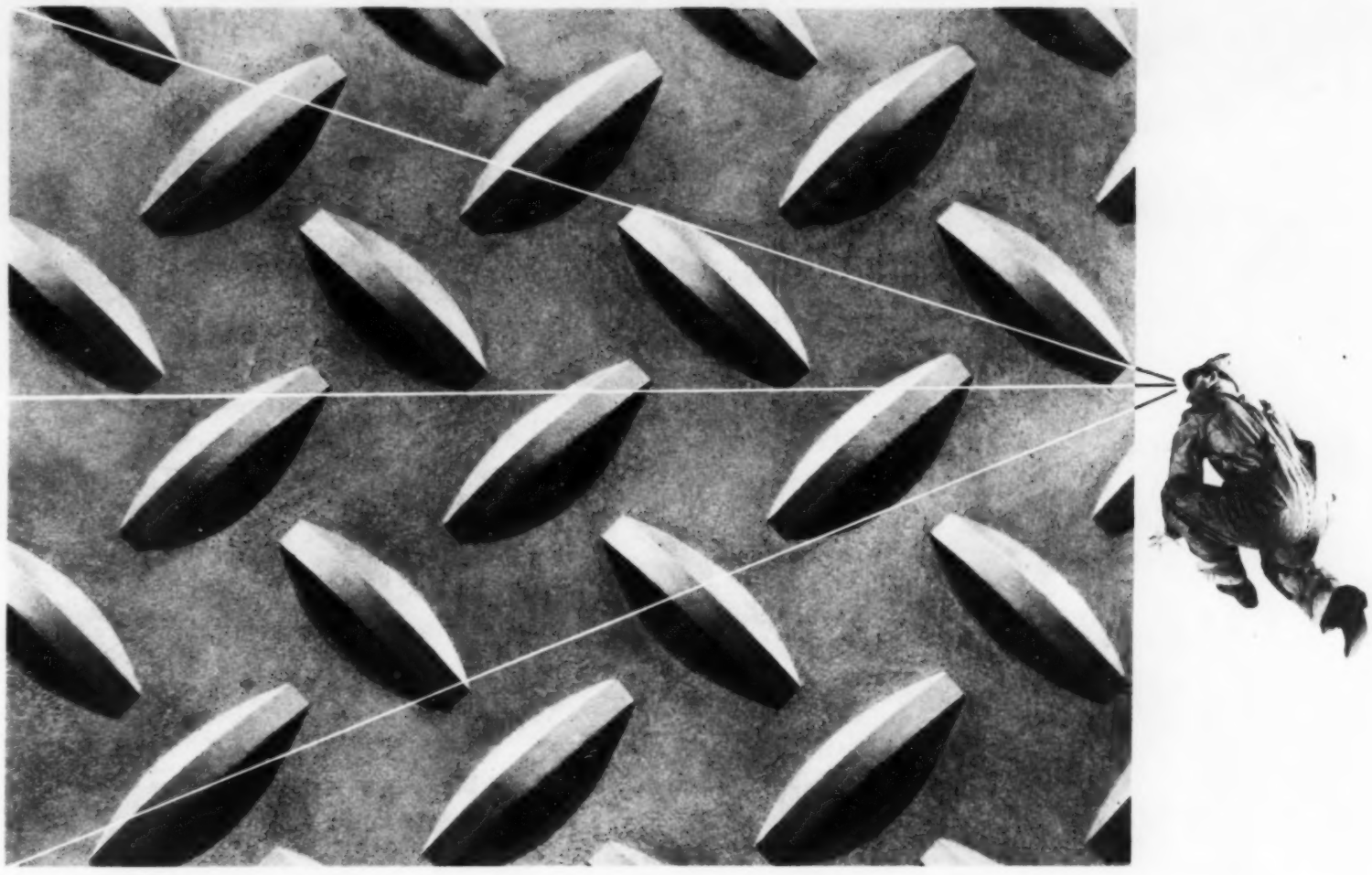
In Business for Your Safety

GREEN SIGNIFIES SAFETY

District Offices: Atlanta, Chicago, Detroit, Denver, New York, Philadelphia, Pittsburgh, Houston, San Francisco

TRU·LAY *Preformed* Wire Rope

ALL AMERICAN CABLE COMPANY ROPES MADE OF IMPROVED PLOW STEEL ARE IDENTIFIED BY THE EMERALD STRAND



A Glance Proves Extra Stiffness of Inland 4-Way Floor Plate

4-Way Safety

Extra Stiffness

4-Way Matching

4-Way Drainage

There is no line of weakness either lengthwise or crosswise in the Inland 4-Way Floor Plate. Projections overlap—reinforce one another. This extra stiffness and strength is an important reason why Inland 4-Way is the most widely used floor plate today, especially where the plate must support a load.

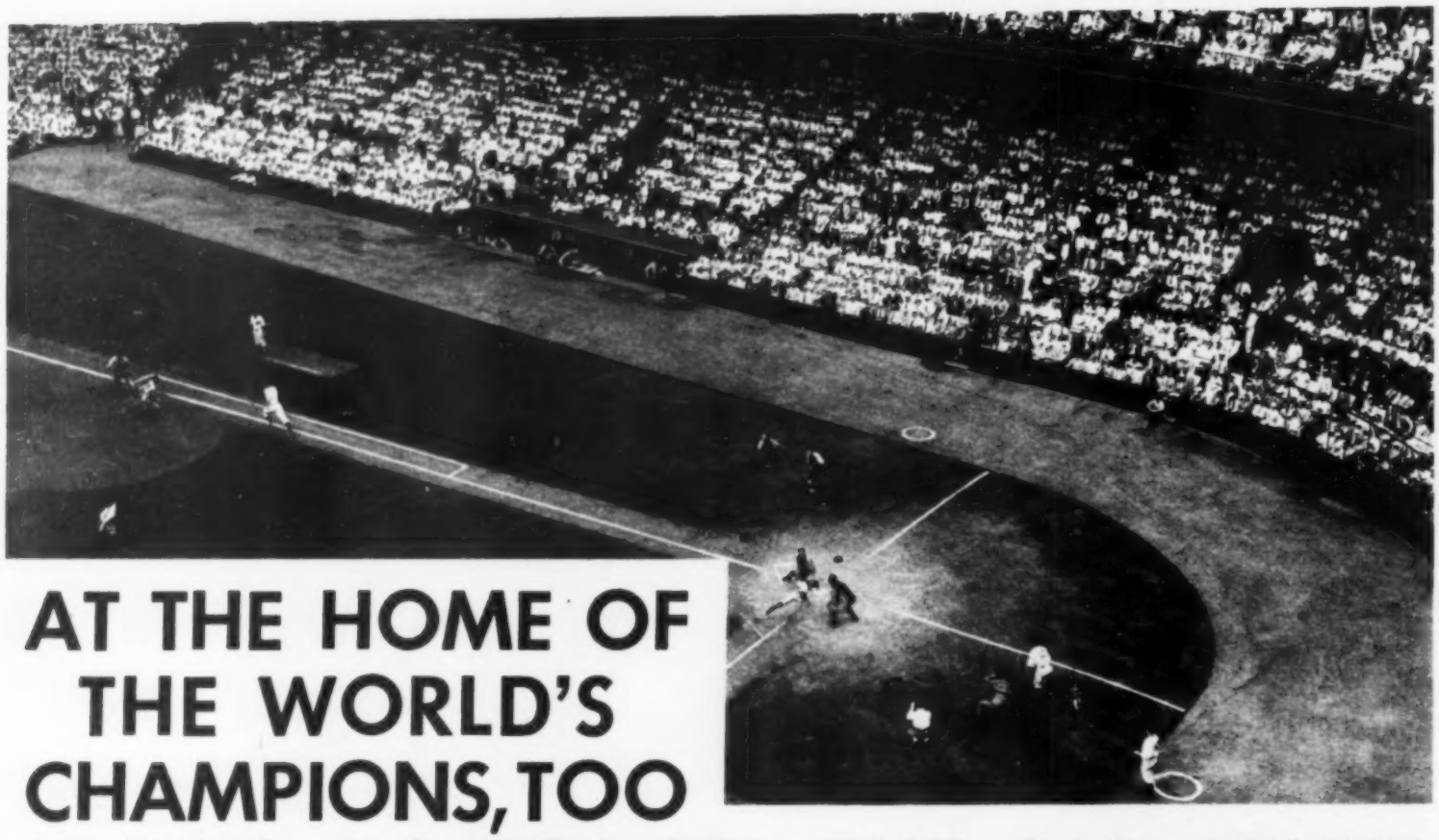
Other reasons are 4-Way Safety—equal traction for wheel or foot 4-ways instead of two; 4-Way Drainage—easy to sweep or scrub in the direction most convenient; and 4-Way Matching—a continuous pattern across the area covered.

Secure these 4 advantages by standardizing on Inland 4-Way Floor Plate for all danger spots in your plant and on equipment you use or sell. Helpful literature mailed on request.

SHEETS • STRIP • TIN PLATE • BARS • PLATES • STRUCTURALS • PILING • RIVETS • BILLETS • RAILS • TRACK ACCESSORIES

INLAND STEEL CO.

General Offices: 38 South Dearborn Street, Chicago, Illinois



AT THE HOME OF THE WORLD'S CHAMPIONS, TOO

IT PAID TO FORGET THE OLD STUFF

● Just as those Detroit Tigers dashed through the American League to a World's Championship, the contractors who rebuilt Navin Field, Detroit, also played "head's up" ball.

They Forgot the Old Stuff.

In the zero weather of Detroit's winter, so that the park would be ready for opening day, 40,000 yards of concrete was placed with the Rex Pumpcrete—one of the new standard tools of the construction industry.

Equipment that is already owned, methods of the years before are often the drag that brings too high costs on modern construction jobs.

In 1936, before you buy, before you bid, investigate the up-to-date methods of handling concrete.

CHAIN BELT COMPANY, 1633 West Bruce Street, Milwaukee, Wisconsin

MIX EN ROUTE OR PUMP YOUR CONCRETE

Ask us Which?

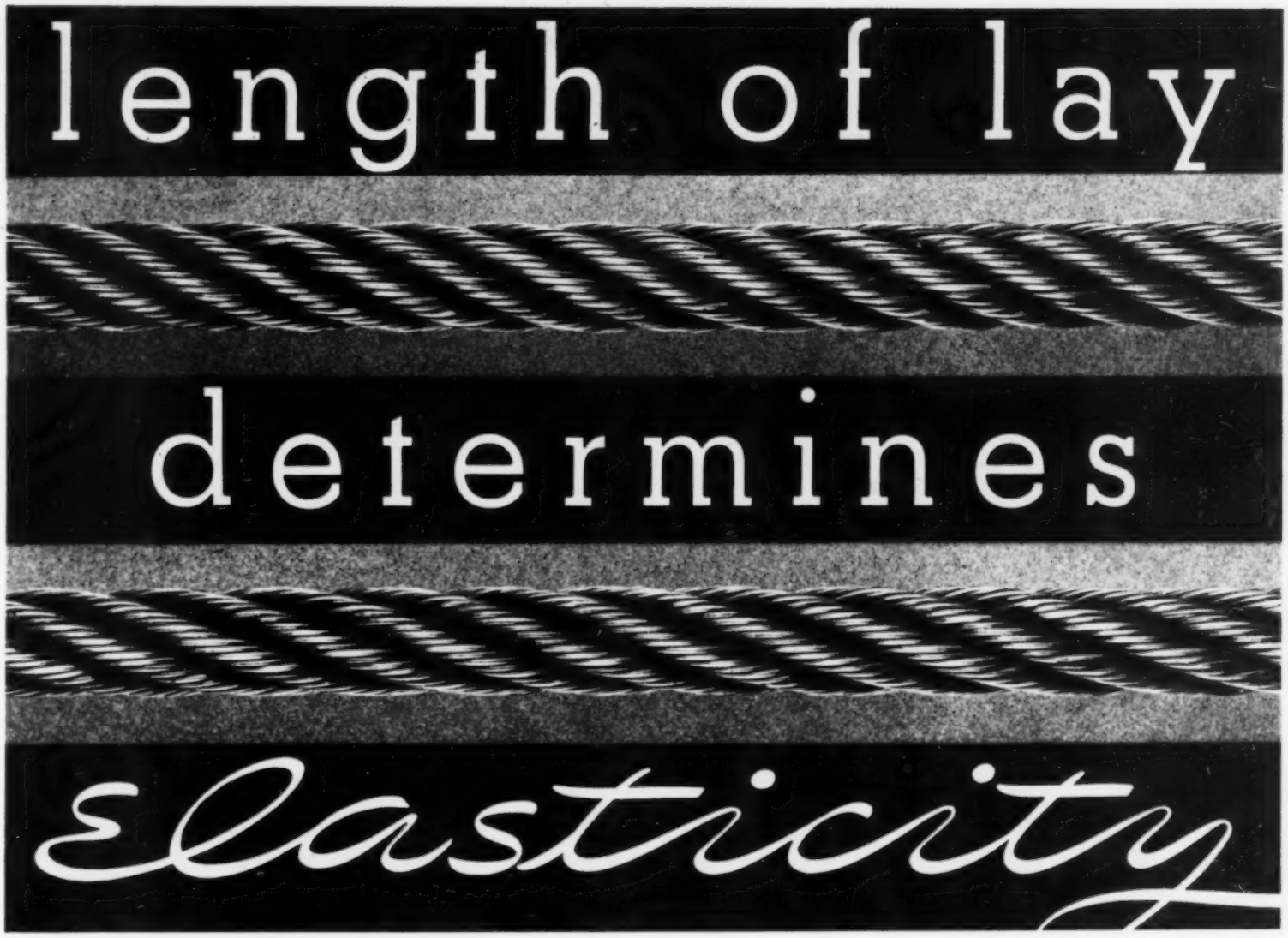
IT MAY BE BOTH

The Up to Date Methods of Handling Concrete

REX

CHAIN BELT COMPANY
of MILWAUKEE

Construction Equipment



Select the Rope that Fits Your Job

Elasticity must not be confused with stretch. The ability of a rope to resume its normal length after elongation enables it to bring a moving load up to speed gradually, thereby preventing shock. Length of lay, the distance along the rope axis required by one strand to make a complete revolution, determines elasticity. Shortening this distance increases the elasticity but reduces the strength of the rope. Careful consideration to the rope use should be given when determining the length of lay. We will gladly furnish you with data on the subject to aid your selection. Write.

●

WICKWIRE SPENCER STEEL COMPANY, *General Offices:* 41 East 42nd Street, New York. *Sales Offices and Warehouses:* Worcester, New York, Chicago, Buffalo, San Francisco, Los Angeles; *Export Sales Dept.:* New York.

WICKWIRE SPENCER SALES CORPORATION, New York, Chattanooga, Tulsa, Portland, Seattle.

WIRE ROPE
by Wickwire Spencer

Wickwire Spencer also manufactures all sizes and types of Wire Rope in Wisscolay.

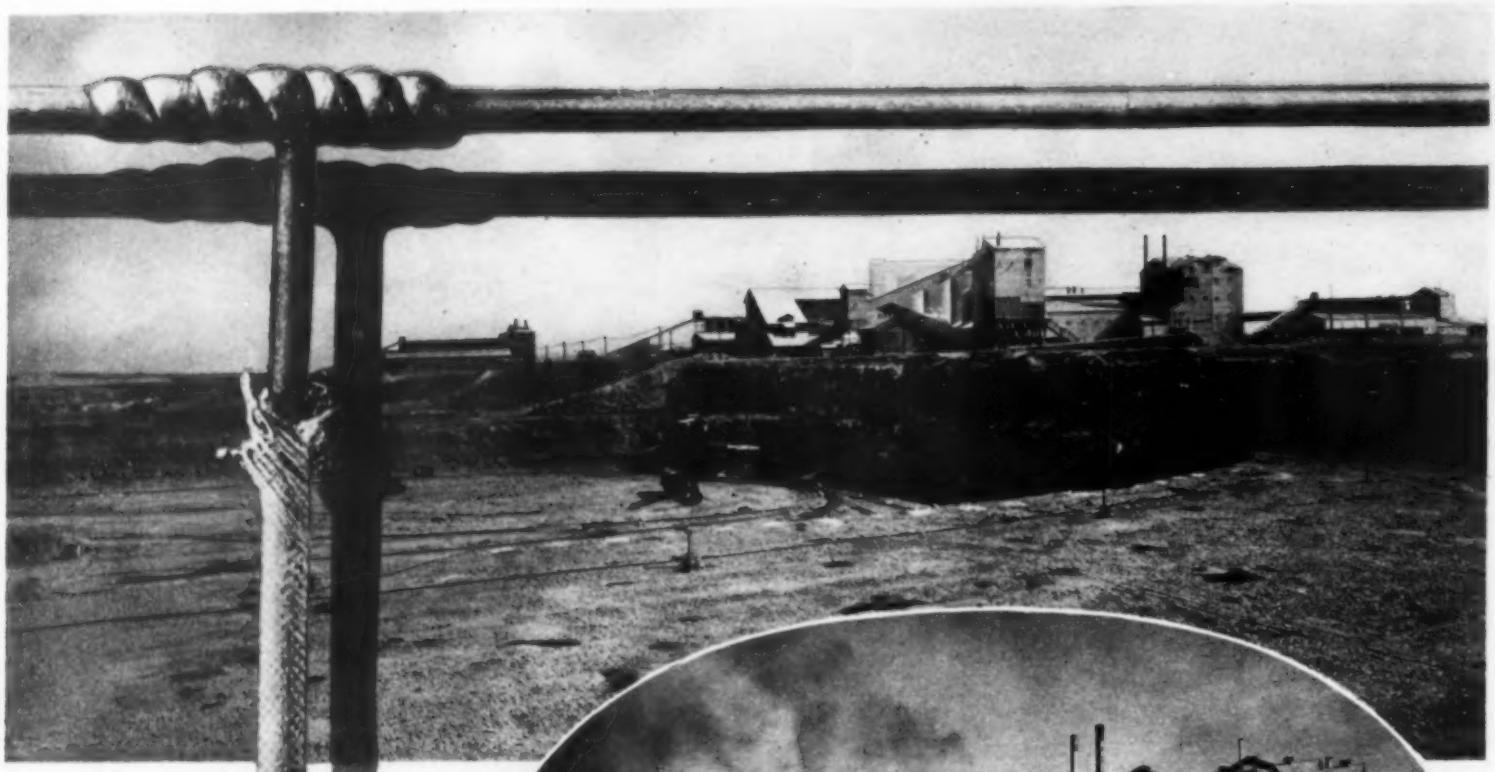
WICKWIRE SPENCER STEEL CO.
41 East 42nd St., New York City
Please send me your new Rope Manual that tells how to make wire rope last longer.

Name_____

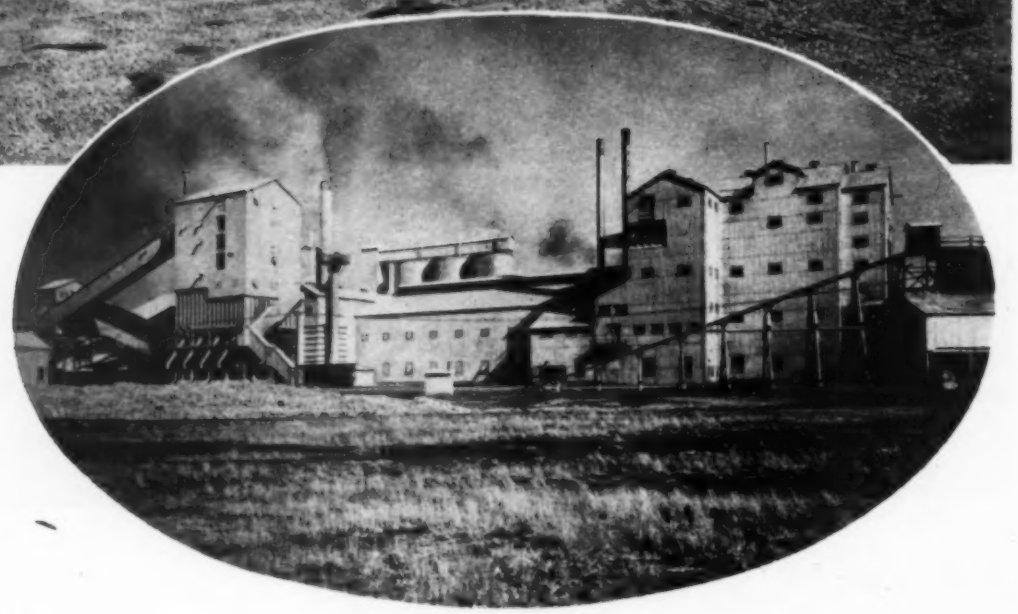
Firm_____

Address_____

City_____ State_____



At the Kelley Island Lime and Transport Company.



CORDEAU-BICKFORD *at the* Kelley Island Lime & Transport Co.

They want "little pieces" at the White Rock Plant at Clay Center, Ohio. Little pieces mean easier removal; save time, save shovels, save powder.

Better Fragmentation is but one of the five reasons why Cordeau-Bickford Detonating Fuse is used here — as elsewhere in the quarrying industry.

Here are the five reasons:

1. More Work from Explosives: each cartridge is detonated directly and has the added force of a primer cartridge.
2. Simplified Loading: there are no caps in the holes.
3. Less Hazard: Cordeau-Bickford is insensitive to ordinary shocks. It must be detonated.
4. Fewer but Bigger Shots: equipment moved less often, for Cordeau-Bickford not only detonates each hole but connects all holes.
5. Better Fragmentation: planned rotation firing, possible with Cordeau, permits split second relief of burden, letting each charge work to best advantage.

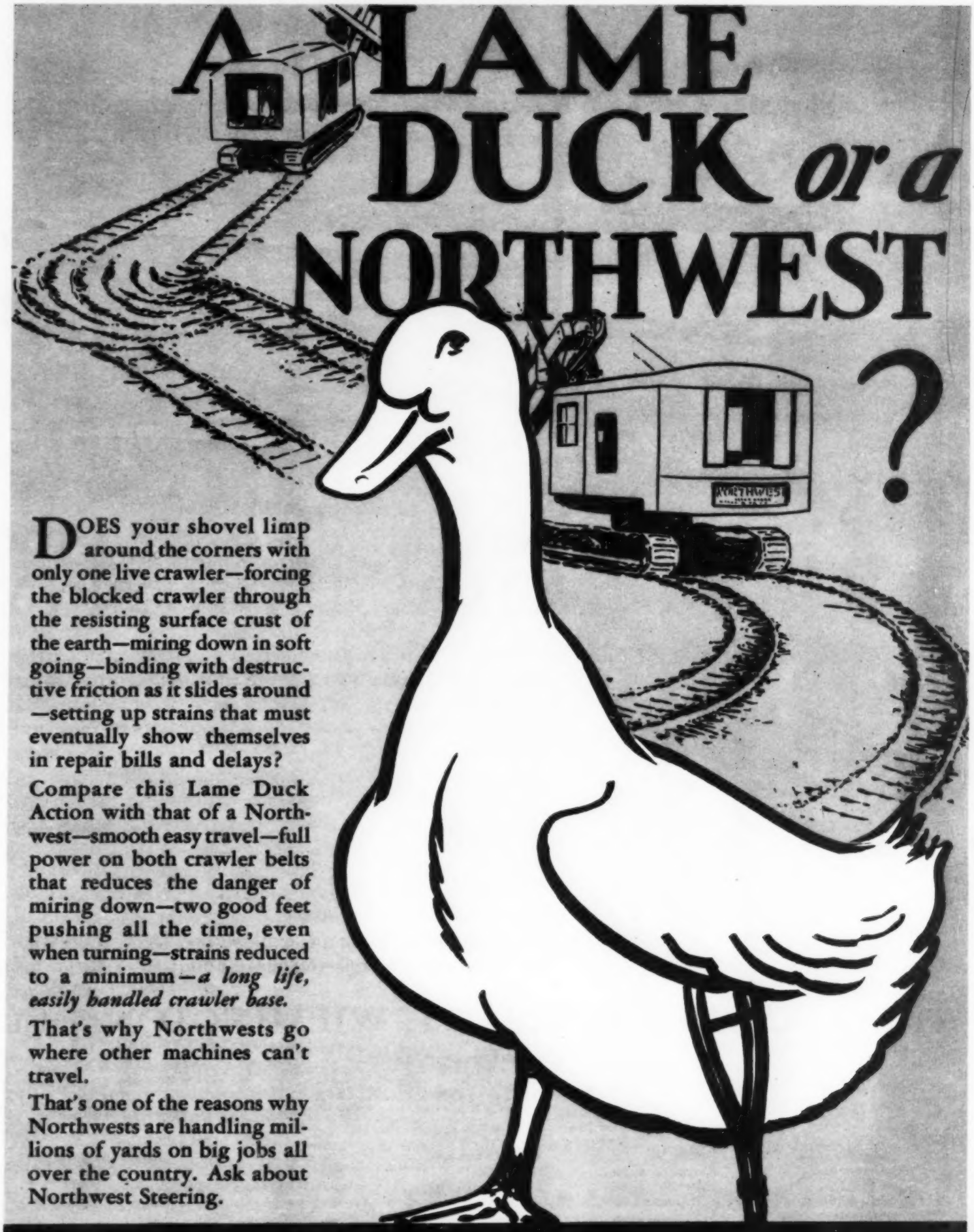
Cordeau-Bickford Detonating Fuse is manufactured with the same care that has made Ensign-Bickford Safety Fuse famous since 1836. Let us send you a copy of our Centennial Booklet — and tell you more about Cordeau.

CB-52

The ENSIGN-BICKFORD COMPANY, Simsbury, Connecticut

SAFETY FUSE Since 1836 • CORDEAU-BICKFORD DETONATING FUSE

A LAME DUCK *or a* NORTHWEST ?



DOES your shovel limp around the corners with only one live crawler—forcing the blocked crawler through the resisting surface crust of the earth—miring down in soft going—binding with destructive friction as it slides around—setting up strains that must eventually show themselves in repair bills and delays?

Compare this Lame Duck Action with that of a Northwest—smooth easy travel—full power on both crawler belts that reduces the danger of miring down—two good feet pushing all the time, even when turning—strains reduced to a minimum—*a long life, easily handled crawler base.*

That's why Northwests go where other machines can't travel.

That's one of the reasons why Northwests are handling millions of yards on big jobs all over the country. Ask about Northwest Steering.

NORTHWEST ENGINEERING CO., 1728 Steger Bldg., 28 East Jackson Blvd., Chicago, Ill., U. S. A.

SHOVELS, CRANES
DRAGLINES
PULLSHOVELS
SKIMMERS

NORTHWEST

GASOLINE, OIL
DIESEL OR
ELECTRIC
POWERED

BUILT IN A RANGE OF 15 SIZES — 3/8 YD. CAPACITY AND LARGER

You can do it with the ATLAS TWIN FIFTY

Used with three leading wires the Atlas Twin Fifty Blasting Machine fires a *first* and a *second* series of 50 caps each—with an interval of *only a few thousandths of a second between*—at a single stroke of the rackbar! Accuracy in directing the force of explosives is greatly increased by this slight interval between firing. In actual performance, fragmentation has been increased . . . back break reduced . . . pulverization lessened!

The Atlas Twin Fifty Electric Blasting Machine makes possible a great advance in the application of the controlled force of explosives. Ask the Atlas representative to tell you more about it.

ATLAS POWDER COMPANY, WILMINGTON, DEL.

Cable Address—Atpowco

Everything for Blasting

OFFICES

Allentown, Pa.	Joplin, Mo.	New Orleans, La.	Pittsburgh, Pa.	Spokane, Wash.
Boston, Mass.	Kansas City, Mo.	New York, N. Y.	Portland, Oregon	St. Louis, Mo.
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Denver, Colo.	Los Angeles, Calif.	Picher, Okla.	San Francisco, Calif.	Wilkes-Barre, Pa.
Houghton, Mich.	Memphis, Tenn.	Pittsburg, Kansas	Seattle, Wash.	

ATLAS
EXPLOSIVES

CHEMICALS ATLAS EXPLOSIVES

Carbody and corduroy frames are welded into a single unit — lighter, stronger, so rigid it cannot "weave."

HERE'S a machine that gets around so fast you can schedule it for working time with mighty little leeway for travel time. On a truck or trailer mounting it makes forty miles an hour handily. Crawler mounted it can be loaded or unloaded from its special trailer in ten minutes. You can handle jobs all over the map with a Bantam-Weight. ● And it has many brand new features that make it a high producer for little money. High-tensile alloy steels and welded construction are used to reduce weight to a point where it can go 'most any place. ● A very rapid digging cycle with rugged non-stalling power make it a producer on all dirt-moving jobs from 50 to 50,000 yards. Write today for full information on this really new development in light-weight excavators.

HARNISCHFEGER CORPORATION
4494 W. NATIONAL AVENUE — MILWAUKEE, WISCONSIN

P&H BANTAM WEIGHT

MAKES HIGHWAY FUNDS GO FURTHER

ONE OF THE 22 P&H PACEMAKERS FOR 1936

Traffic markers of Atlas White Portland Cement on West Jefferson Avenue, River Rouge, Michigan
Installed by Board of County Road Commissioners, Wayne County, Michigan. J. K. Norton, Road Engineer

UNTIL two years ago, traffic on this street *crawled*. Now cars move swiftly, orderly, *safely*. The change came when, in 1934, the pavement was widened to 90 feet, and a marker of Atlas White Cement was installed straight down the middle.

In town, or in the country, the fellow behind the wheel has a wholesome respect for these white markers. (Many drivers would no more think of crossing the line than of crossing a hard-boiled cop.)

And Atlas White markers have no "hours." They're on the job day and night, always white, always easy to see.

Moreover, they're *permanent*—made of solid white concrete that becomes a permanent part of the asphalt, brick, or concrete paving—built to last as long as the pavement lasts. Their hard surface can't be worn away, can't fade out. There is never need for replacement, never any maintenance cost. Their first cost, though higher, is the last cost.

You will be interested in the complete story of these economical safety markers. Write for it.

Help Build Safety into Streets and Highways with Atlas White Traffic Markers • Made with Atlas White Portland Cement • Plain and Waterproofed

UNIVERSAL ATLAS CEMENT CO.

United States Steel Corporation Subsidiary **208 South La Salle Street, Chicago**

M-5

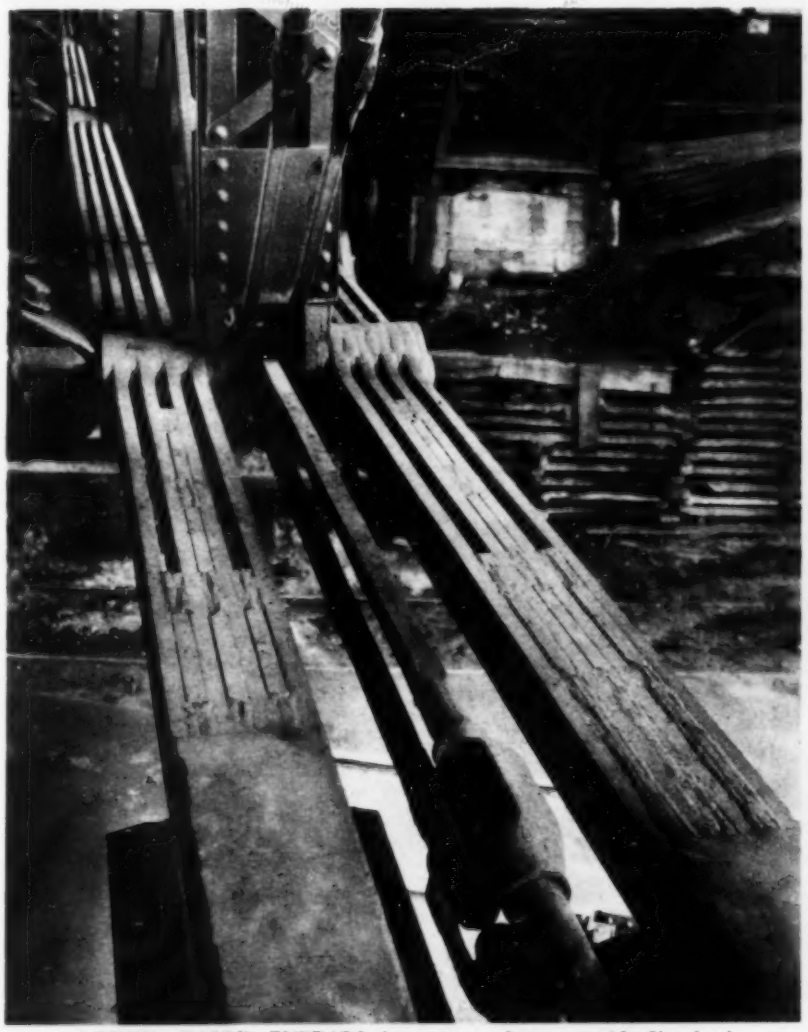
ATLAS WHITE PORTLAND CEMENT FOR TRAFFIC MARKERS

Construction Methods

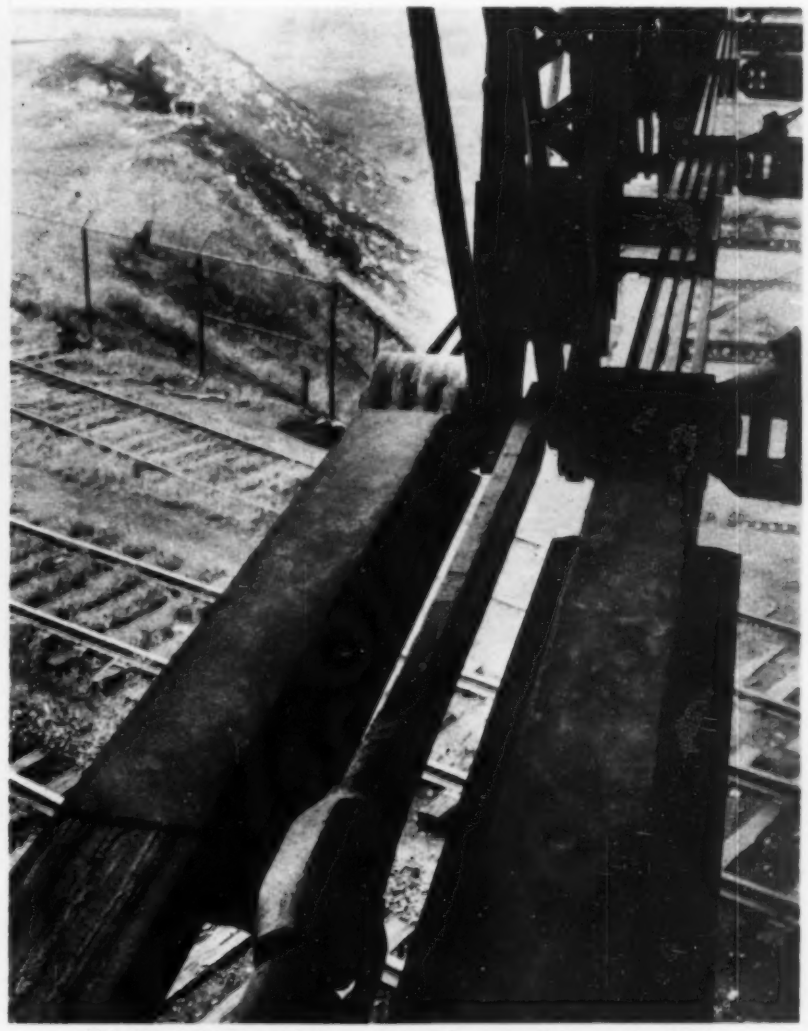
ROBERT K. TOMLIN, Editor

Established 1919—McGraw-Hill Publishing Company, Inc.

Volume 18—Number 6—New York, June, 1936



LOWER CHORD EYEBARS in trusses of 50-year-old Cleveland bridge over railroad tracks are strengthened by addition of plates and arc welding after they have become corroded by locomotive fumes.



SMOKE PLATES welded to tops and bottoms of lower chords after they have been reinforced protect repaired portions above tracks from further corrosive action.

Welders Reinforce Corroded Bridge Members

ARC-WELDING REPAIRS of corroded eyebars in the lower chords of a 50-year-old bridge across the Erie railroad tracks at East 34th St., Cleveland, recently saved the city $10,000 over other methods of reinforcing or rebuilding the weakened structure, according to Paul Simon, of the Ohio Machine & Boiler Co., which performed the work. The eyebars are only 6 in. above locomotive stacks, and corrosive fumes had eaten badly into the steel members.

By electric welding it was possible to repair the bridge without dismantling it or erecting falsework. The accompanying photographs indicate the nature of the repairs. Corroded portions of the eyebars were chipped away to expose sound metal. Lengths of steel plate then were inserted between the eyebars and welded in place. Openings between the old and new steel were filled with weld metal. After reinforcing the eyebars in this way, the contractor welded smoke plates to the tops and bottoms of the lower chords.

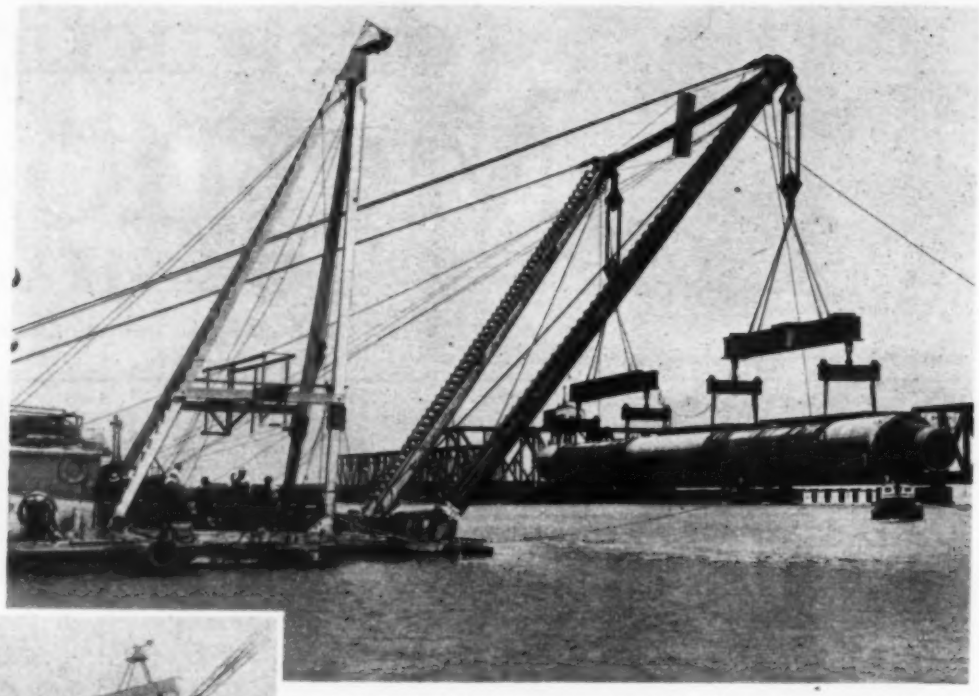
A total of 500 lin. ft. of welding was involved in the repairs. This total included 200 ft. of overhead welding on the under side of the chords, 200 ft. of down-hand welding on the upper side and 100 ft. of miscellaneous work. All welding was done with Lincoln electrodes and welding machines.

Passing trains seriously handicapped work on the bridge. To prevent accidents it was necessary for one man to stand by and give warning of approaching trains to the welders, who did their work from ladders. Welding cable, wire brushes and other equipment had to be tied down against the force of locomotive exhausts. The bridge was open to traffic at all times during the period of repairs, and the work was completed ahead of schedule.

Repairs to the bridge were carried out under the direction of the Department of Bridges and Docks of the City of Cleveland. So far as the lower chords of its trusses are concerned, the East 34th St. bridge across the Erie tracks now is stronger than ever.

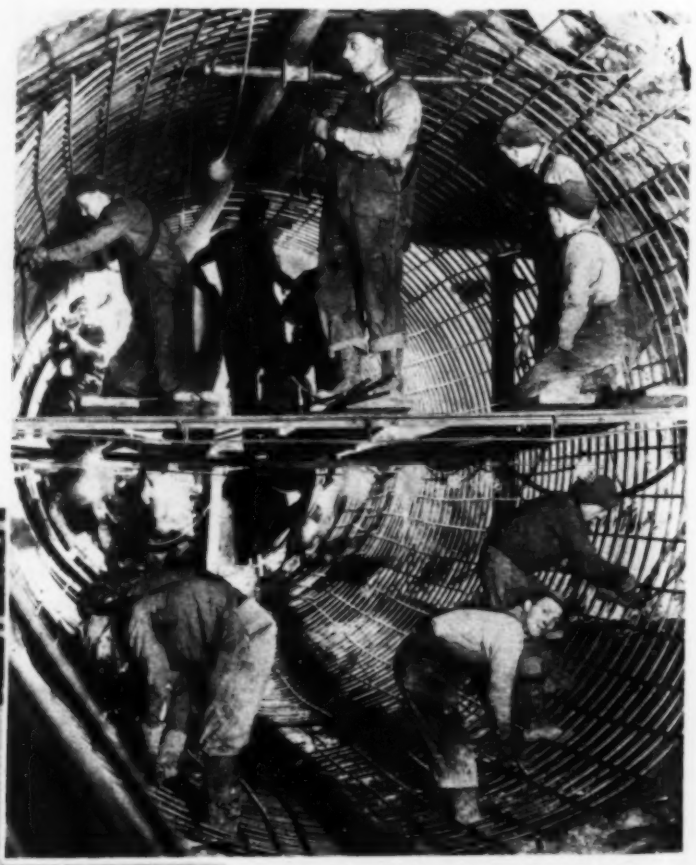
This Month's

"NEWS REEL"



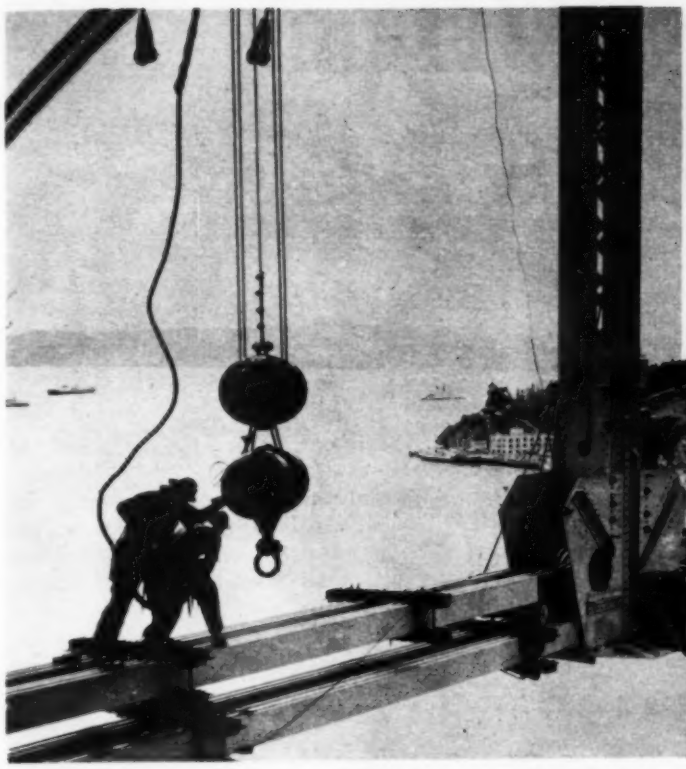
CONCRETE-JACKETED STEEL PIPE 54 in. in diameter is laid in 120-ft. sections weighing 100 tons to form dual subaqueous conduit 2,600 ft. long carrying water supply from Hetch Hetchy sources across San Francisco bay to reservoirs of San Francisco peninsula. Steel ¾ in. thick is fabricated in 30-ft. lengths of which four are butt-welded to form 120-ft. sections fitted on ends with heavy steel flanges for bolted connections. Concrete jacket 6 in. thick is poured around pipe in wood forms on barges. Pipe lines are supported under water on trestle bents with timber cradles above caps. Bay crossing, designed by San Francisco Water Department, was constructed by Pacific Bridge Co. for San Francisco Public Utilities Commission.

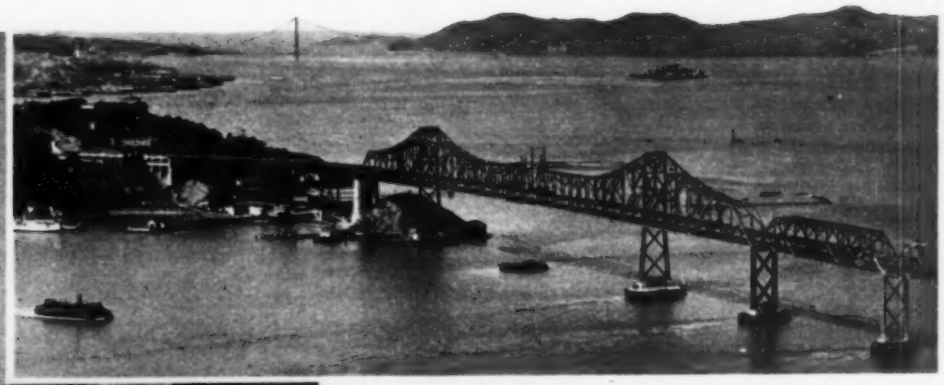
TYGART DAM takes form on Tygart River, near Grafton, W. Va., as revolving cranes of Frederick Snare Corp., New York contractor, operating on steel trestles built in three lifts to height of 174½ ft., place concrete in gravity-type structure 232 ft. in maximum height and 1,850 ft. long. Project is being built under $6,306,000 contract with Corps of Engineers, U. S. Army, as described in "Construction Methods" for November, 1935, pp. 46-47.



MOFFAT WATER TUNNEL, crossing under Continental Divide, is under construction to augment supply of Denver, Colo., from Fraser River sources on west side of Rocky Mountains. Steel reinforcement is being placed for 10½-ft. diameter circular concrete lining of approximately half of 6.2-mi. bore driven originally as pioneer tunnel for railroad tunnel completed in 1928. Work is being done by Utah-Bechtel-Morrison-Kaiser Co., contractors, for Denver's Board of Water Commissioners, of which Col. Herbert S. Crocker is consulting engineer.

TRIBOROUGH BRIDGE *(below)* spans Hell Gate channel of East River between Astoria, Long Island and Ward's Island, New York City, forming part of 9½-mi. traffic link between boroughs of Queens, Manhattan and The Bronx, financed by a $44,200,000 PWA loan and grant. Suspension span of structure is 1,380 ft. long, carried by 300-ft. steel towers. For the Triborough Bridge Authority O. H. Ammann is chief engineer.

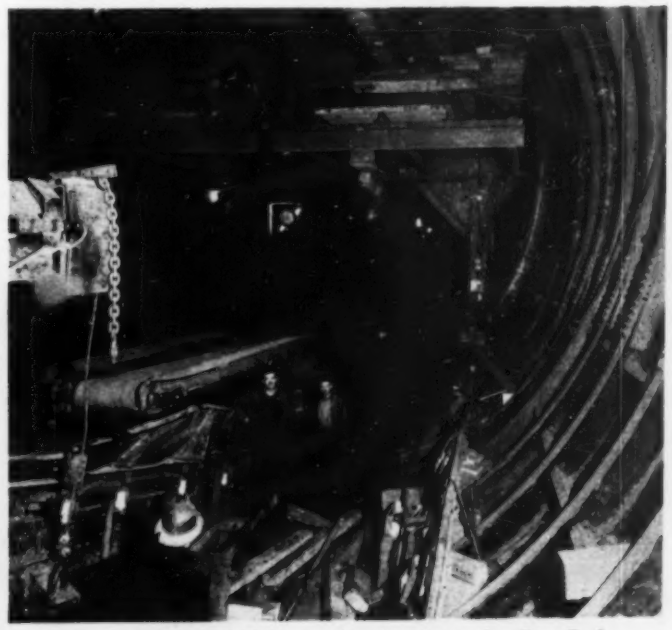




CLOSURE IS COMPLETED *(left and above)* on 1,400-ft. cantilever span of East Bay crossing of $77,600,000 San Francisco-Oakland Bay bridge. Eye-bars on lower chord *(left)* are first steel members to fill gap between approaching ends of huge structure. Connection was made by driving pin 3 ft. in length and weighing ½ ton through holes in eye-bars and plates of vertical post, after they had been jockeyed into position by longitudinal jacks. —*Photos from* CALIFORNIA TOLL BRIDGE AUTHORITY, *of which* C. H. PURCELL *is chief engineer.*

FILL FOR CAJALCO DAM and dike, involving placement and compaction of 7,000,000 cu. yd. of earth to create terminal reservoir at west end of 241-mi. Colorado River aqueduct in California, is obtained from borrow pits and hauled 2½ mi. to site by fleet of 30 Mack chain-drive trucks, with 10-yd. bodies, operated on Butane gas, a hitherto wasted byproduct of petroleum, instead of gasoline. Dam being built for Metropolitan Water District by Griffith Co., contractor of Los Angeles, under $4,647,000 contract, will be 194 ft. high and about ½ mi. long on crest, supplemented by 90-ft. high earth dike 7,500 ft. in length. Each truck is equipped with two 50-gal. pressure tanks for carrying the gaseous fuel and necessary changes are made in carburetion for operation with Butane gas.

STEEL RIB ERECTION *(below)* is begun by American Bridge Co. on 800-ft. hingeless arch for Henry Hudson bridge across Harlem Ship Canal, New York City. Ribs are double-web box girders 12½ ft. deep and 3 ft. 8 in. wide. Falsework bents will support shore ends of structure and closure of arch will be by cantilever method.



TUNNEL ENLARGEMENT on diversion bores for Fort Peck dam in Montana is under way by Government plant and day labor, under direction of Corps of Engineers, U. S. Army. View shows steel lining, mucking machine and walking jumbo. Excavated diameter of tunnel is 32 ft. For most of lengths of four tunnels diameter will be 24 ft. 8 in. inside concrete lining.

FALSEWORK ON WHEELS

Places Railroad Bridge in Halves

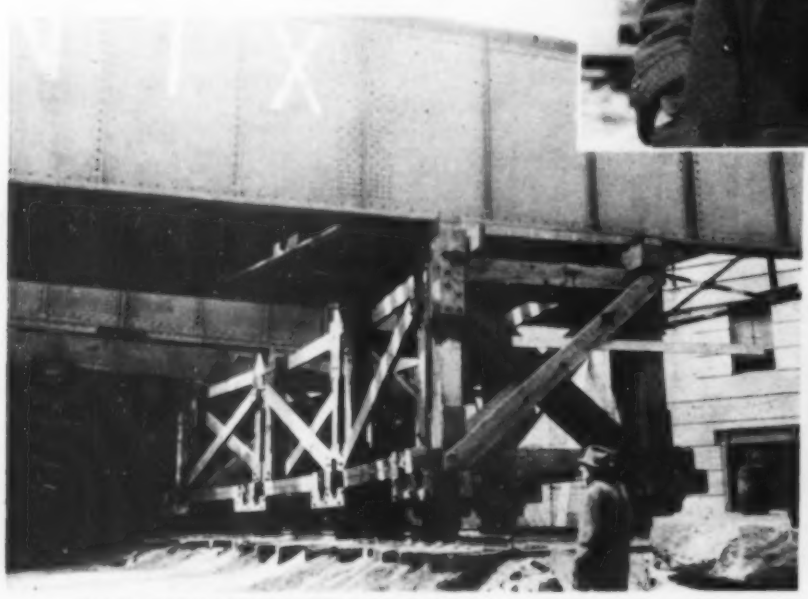
TIMBER FALSEWORK traveling on wheels and carrying completely assembled halves of a new 6-track, 1,050-ton steel plate-girder railroad bridge with concrete deck, made it possible for the Central Railroad of New Jersey to remove and replace with a longer structure the existing overhead crossing at Ward St., on the route of the McCarter Highway near Hamilton Ave., a short distance southeast of the business center of Newark, N. J. The work, involving a total cost of about $250,000, was undertaken under a contract with the Tuller Construction Co., of Red Bank, N. J., as a PWA grade-crossing project in connection with the widening of New Jersey State Highway No. 21 which has been extended from a present paved width of approximately 30 ft. to 66 ft. between curbs, necessitating an overhead railroad crossing with a span of about 98 ft. instead of the old 50-ft. span. The railroad line is a busy one, handling 100 trains daily and serving not only the Broad St. Station in Newark but also a freight yard and warehouse adjacent to the bridge site.

Plan of Operations — In planning the bridge replacement operations, therefore, it was necessary to devise a scheme of demolition and reconstruction which would permit normal traffic during the larger portion of the construction period. At no time could traffic be completely suspended; at least two tracks had to be available at all times. The plan proposed by the railroad company at the time the contract was let contemplated the building of two sections of stationary wooden falsework, one section on the south and the other on the north of the existing bridge. On this falsework the new bridge was to be erected complete, with concrete deck and waterproofing, approximately one-half of the new bridge being carried by each section. Each unit was then to be moved into its new position by rolling along the top of the supporting falsework. The presence of a large warehouse structure abutting on the north side of the bridge limited lateral clearance and made necessary a curved path for moving the northerly section of the new bridge into place.

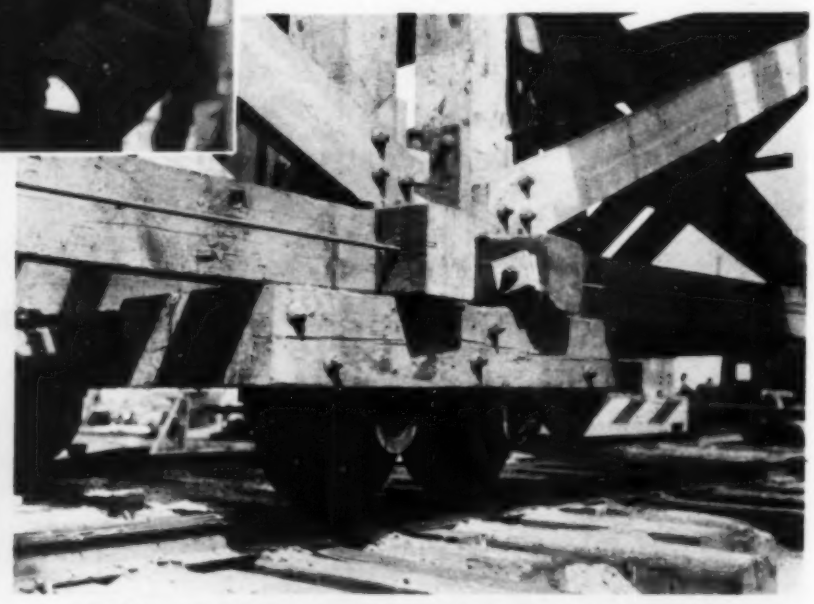
The contract provided, however, that the contractor might use an alternate scheme for moving the new bridge into place if he felt it was desirable. The Tuller Construction Co. accordingly submitted to the railroad an alternate scheme which provided only sufficient movable falsework for erecting the new bridge in its temporary location. This falsework was equipped with wheels, running on wide-gage railroad tracks laid at the street level to carry the assembled bridge sections into place. In other words, the final plan involved moving the wheel-mounted

ALMOST READY FOR MOVE. North half of new bridge, erected complete with floor system, rests on movable falsework, while north half of old bridge is being demolished with aid of locomotive crane.

J. D. TULLER, president of Tuller Construction Co., of Red Bank, N. J.



FALSEWORK ON WHEELS, operating on curved track carrying 90-lb. rails, supports big steel girders of north half of new bridge.



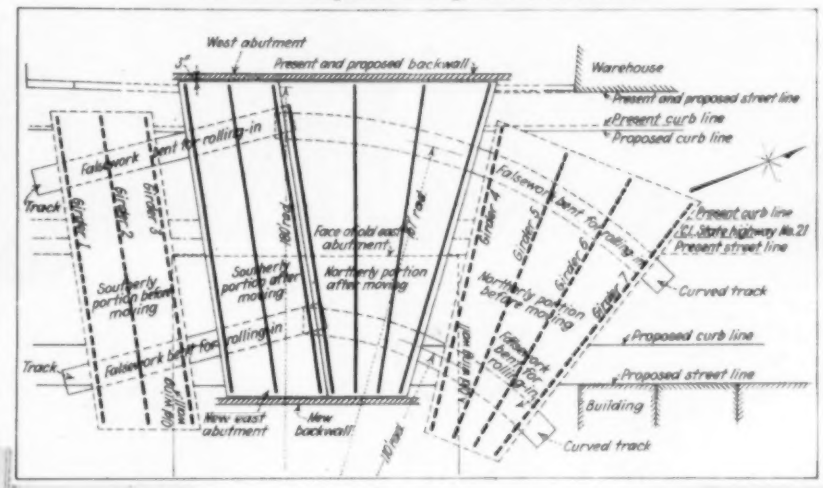
DETAIL OF WHEEL SUPPORT of falsework carrying new bridge section. Wheels are of cast steel, double-flanged, with 5½-in. axles.

SECOND GIRDER of south half of new bridge is unloaded from railway car by pair of locomotive cranes and lowered on to falsework alongside first girder which is already in place.

falsework trestles and the loads of assembled structural steel they carried as units rather than propelling the steelwork on rollers along the tops of stationary timber falsework.

The existing bridge carrying 6 railroad tracks above the McCarter highway consisted of a series of 13 plate girders about 7 ft. high, with a span of 50 ft. The new bridge comprises 7 plate girders 9 ft. 4½ in. high (without cover plates) with a maximum span of 98 ft. to accommodate the widened state highway route beneath them. As a preliminary to erecting the new structure temporary wooden pile bents were driven to support the track east of the old bridge. The old concrete abutment and retaining walls at this point were then removed by drilling and blasting with light

A STUDY IN CURVES AND CLEARANCES ***(below)*** **had to be made in order to move new bridge sections into place along curved track (at north) and straight skew track (at south). East backwall was left incompleted until girders were seated.**



LOWERED ON TO FALSEWORK first girder of south half of new bridge is handled by pair of locomotive cranes operating on old bridge across McCarter highway.

charges of explosive to prevent damage to the old bridge, which had to be maintained in service throughout the reconstruction operations. Excavation for the widened highway underpass then proceeded between the pile bents and a new concrete abutment was poured for seating the easterly ends of the longer girders of the new structure. The west abutment, however, was retained in its original location, but it had to be underpinned and cut down to accommodate the plate girders of the new bridge which were about 2½ ft. deeper than the old ones.

The major operations involved, which were carried out in the order given, included the following: (1) Underpinning of west abutment; (2) removal of old concrete wing-walls adjacent to east abutment; (3) earth excavation included between wing-walls and underneath railroad structure; (4) construction of new reinforced concrete abutment; (5) removing old concrete and stone abutment; (6) laying of track and erection thereon of movable falsework; (7) erection of structural steel; (8) placing concrete deck; (9) waterproofing new concrete; (10) removal of old steel bridge in two sections; (11) moving new steel work into position; (12) gunite work on old west abutment.

Quantities—The principal quantities involved in the job were:

Removing old masonry	1,500 cu. yd.
Earth excavation	3,800 " "
Concrete	1,500 " "
Reinforcing steel	9,300 lb.
Removing old steel bridge	217 tons
Erecting new steel	580 "
Waterproofing	7,600 sq. ft.

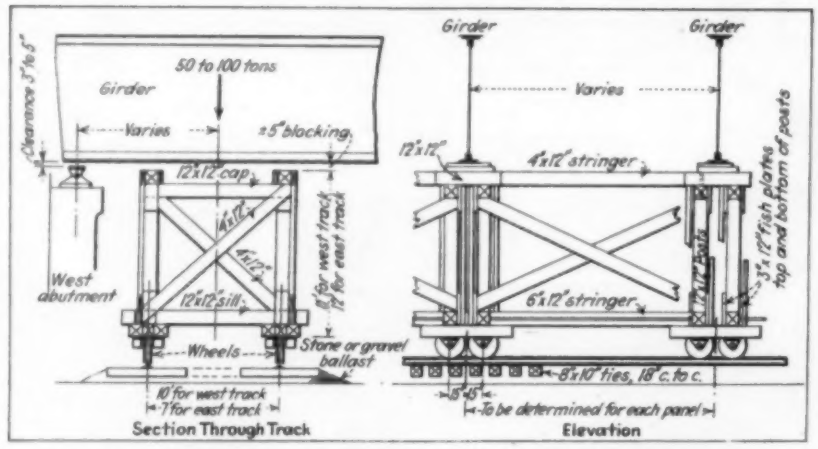
Maintaining Traffic — In order to minimize interruptions to railroad traffic during the replacement of the old bridge a rigid schedule of construction operations was prepared. It provided, first, for the demolition of the northerly half of the old bridge carrying four freight service tracks, and its replacement, within 72 hr., by the northerly section of the new bridge. With the north portion of the bridge temporarily out of service traffic was diverted to the two passenger train tracks on the southerly section of the bridge.

DEMOLITION of old bridge begins on north side to provide space for rolling in half of completely assembled new structure.

After the new north half of the bridge had been moved into place traffic was routed to the four tracks it carried, the southerly half of the bridge was demolished and replaced within 48 hr., by the south section of the new structure.

To provide clearance for moving the new bridge section into place completion of the back-wall of the west abutment had to be delayed until the girders were seated. Then the back-wall was carried up to full height with the use of high-early-strength concrete.

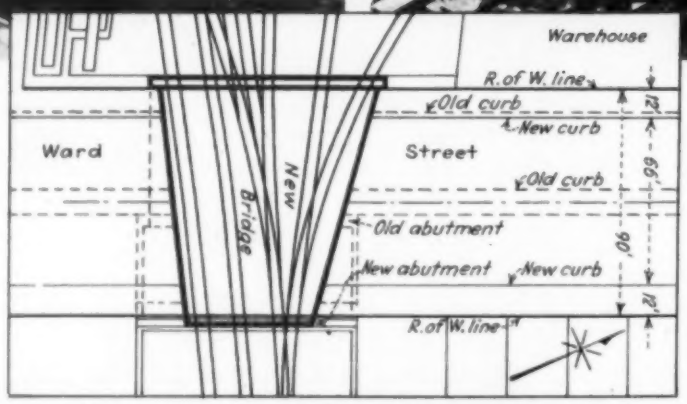
In general the two sections into which the new bridge was divided for purposes of erection are similar; the northerly section, comprising four



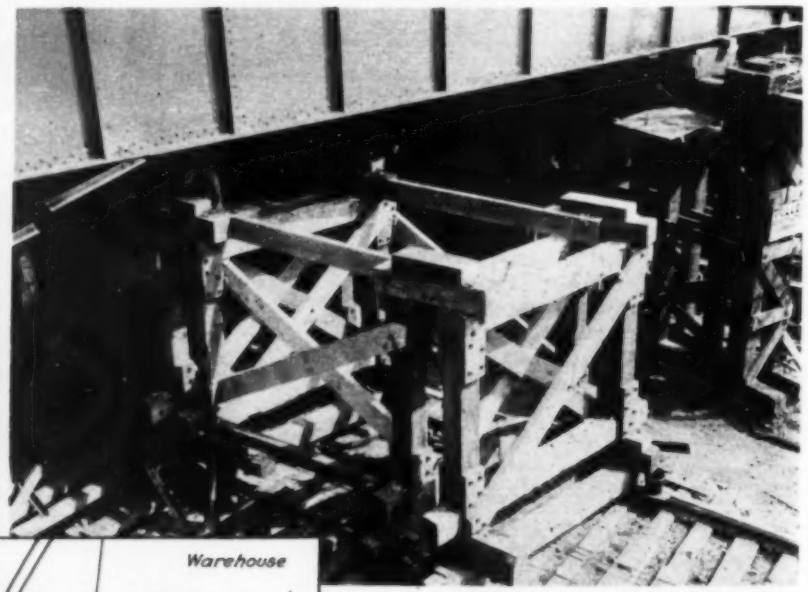
MOVABLE FALSEWORK carrying new bridge girders is timber-framed carriage riding on double-flanged cast-steel wheels.

Depending upon their location in the structure the plate girders weighed from about 60 to 35 tons each. They were delivered from the fabricating shops of the Phoenix Bridge Co. on railway cars spotted on the existing bridge. Unloading was done by two steam-powered locomotive cranes, one a heavy Industrial Works wrecker of 150. tons' capacity and the other a McMyler-Interstate machine of 35 tons' capacity. These cranes, one back of each abutment of the bridge, picked up the new girders from the railway cars, swung them out over the edge of the existing bridge and lowered them to place upon 5-in. blocking above the caps of the movable false-

ASSEMBLY of heavy girders for north half of new bridge on movable falsework.



JOB SITE, showing new, longer bridge carrying railroad tracks over widened Ward St.



SEATING FIRST GIRDER on movable falsework at south side of old railroad bridge.

plate girders, weighs (with concrete floor) about 617 tons, and the southerly section, comprising three plate girders, weighs 426 tons. Girder lengths vary slightly due to differences in the amount of skew. Problems of steel erection and moving the trestle falsework were basically the same for both sections of the new bridge, the chief difference being that the north section, because of interference by adjoining buildings, had to be moved into place along a curved path while the south section was rolled along a straight route.

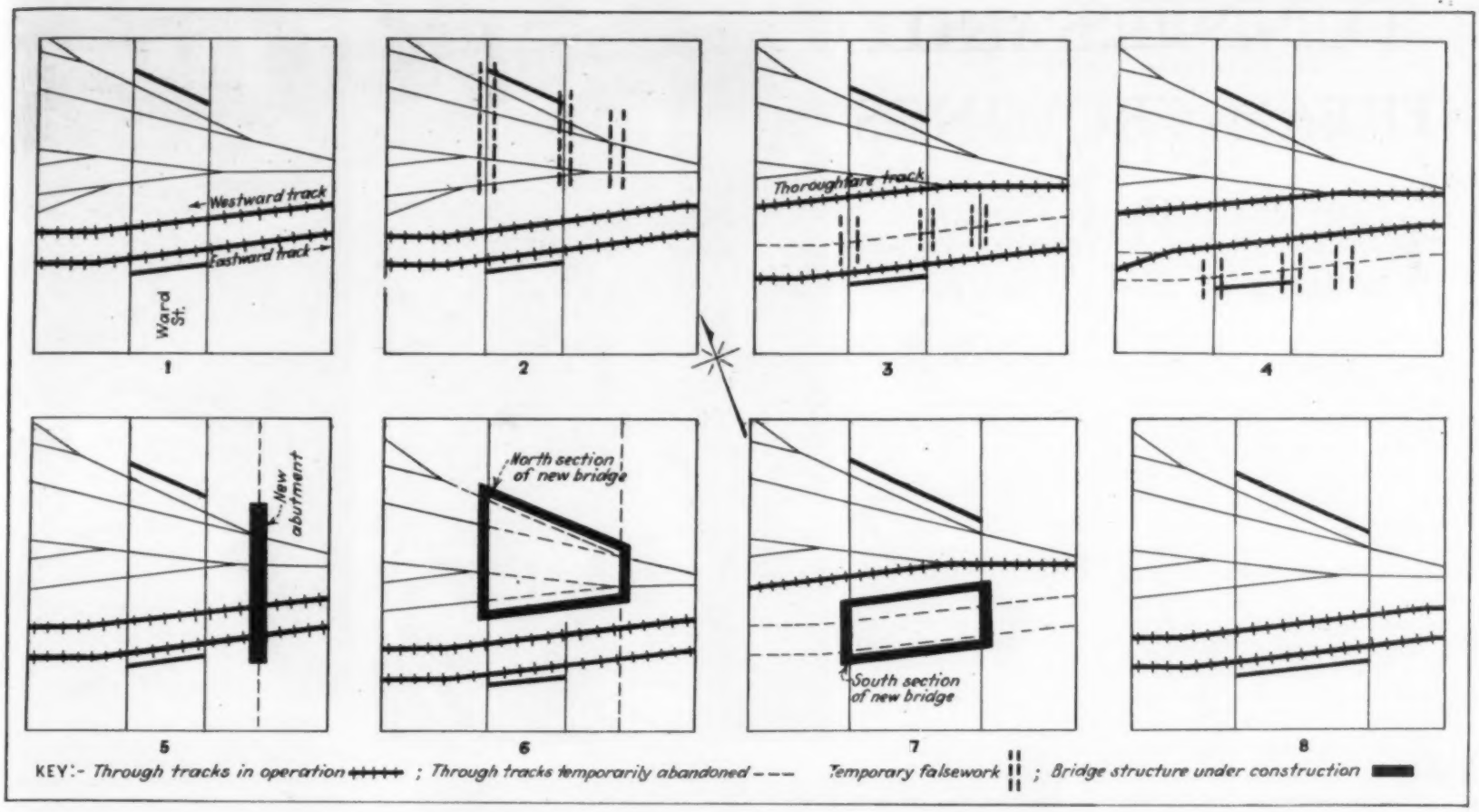
J. C. KESTLER, superintendent for the Tuller Construction Co.

Traveling Falsework — To receive the four heavy girders for the north section of the new structure the contractor first laid on ties and ballast slightly above street level a pair of wide-gage curved tracks with 90-lb. rails to carry the traveling timber falsework trestles on which to erect the steel. The outer track had a gage of 10 ft. and a radius of 167 ft; the inner track had a gage of 7 ft. and a radius of 110 ft. 6 in. The curved track layout was located precisely with the aid of transit and tape so that its path would carry the new bridge section, when moved, exactly to its predetermined place on the abutments prepared to receive it. Along the curved route of movement the clearance between the end of the bridge section and the adjacent back-wall was only 3 in. Upon each track was built an eight-bent (two for each girder) movable timber falsework, consisting of pairs of 12x12 -in. vertical posts, capped, and cross-braced with 12x4-in. bolted timbers, as illustrated. Under each pair of posts were set two 25-in. diameter double-flanged cast-steel wheels with 5½-in. steel axles. Each falsework traveler was equipped with a total of 16 wheels, two for each trestle bent. Loadings on each trestle bent support (including weights of girders and floor system) ranged from 100 to 59 tons, equivalent to a maximum load per wheel of 25 tons.

work. After the outermost girder had thus been lowered and seated the trestle was pulled along its tracks the required distance to receive the next girder. Pulling was done by cable from an electric winch.

Moving Bridge Sections — With all girders in place on the top of the trestle the remaining structural members of the floor system were riveted

J. J. YATES, bridge engineer for the Central Railroad of New Jersey.



TEMPORARY TRACK CHANGES during demolition and replacement of Ward St. bridge for Central Railroad of New Jersey.

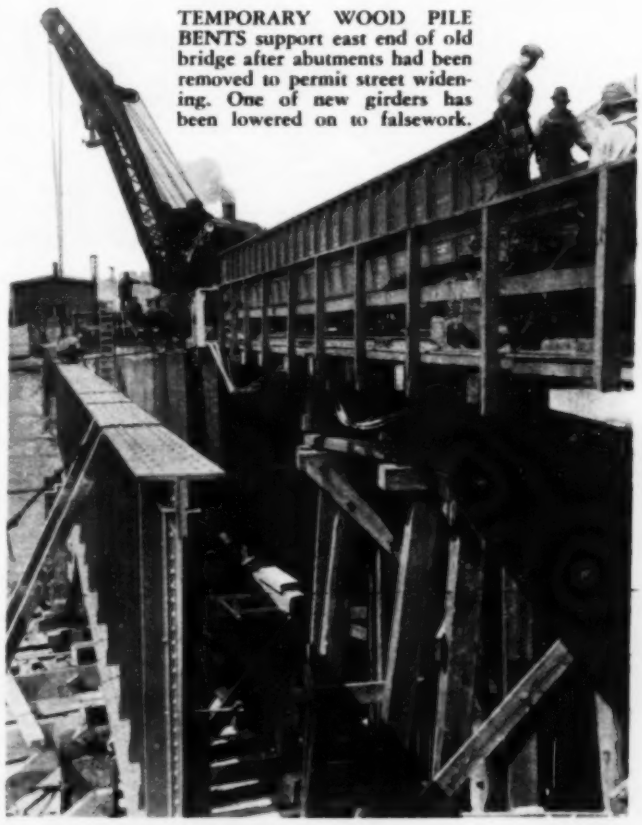
1. Conditions at start of improvement work.
2. Traffic abandoned intermittently on warehouse and freight yard tracks and falsework installed under these tracks (as indicated by vertical dash lines).
3. Westward traffic diverted to thoroughfare track and original westward track (shown by dash line) abandoned. Falsework (vertical dash lines) constructed for westward track.
4. Eastward track abandoned and traffic diverted to westward track. Falsework constructed for eastward track.
5. Eastward and westward tracks restored to normal service. New east abutment built for lengthened bridge.
6. Tracks to warehouse and freight yard abandoned and portion of bridge supporting them removed. North section of new bridge rolled into place on movable falsework trestle.
7. Eastward and westward tracks abandoned and traffic diverted to thoroughfare track for single track operation. South portion of old bridge removed and new south section of span rolled into place on movable falsework.
8. Bridge replacement completed and tracks restored to normal service.

in place, the concrete deck was poured, and waterproofed, and the bridge section now completely assembled, was ready to be moved in to replace the demolished half of the old bridge. After the movement had been completed and shoes attached to the girders, 75-ton hydraulic jacks were placed under the 36-in. floor beams between girders at each end of the bridge section, the wood blocking between the girders and the movable trestles was knocked out and the structure was seated by lowering in ½-in. stages upon its concrete abutments. With the use of high-early-strength cement work was rushed to complete the back walls of the abutment, ballast, ties and track were placed and the bridge section was ready for service.

In moving the north bridge section along its pair of curved tracks a slightly higher rate of travel had to be maintained in pulling the trestle on the outside curved track, of longer radius, than on the inner track. By a nice regulation of moving speeds the two trestles carrying the steelwork were held in proper radial alignment so that the supporting wheels of the trestles were always tangent to the curved track and moved easily along the rails without pinching between the double flanges of the wheels and the rail heads.

For the three girders constituting the south section of the new bridge a procedure similar to that above outlined was followed except that it was possible to lay the track for the falsework in a straight line instead of on a curve. While straight, this line of track was at a 14-deg. skew to the center line of the highway underpass.

In its contract the Central Railroad of New Jersey imposed on the contractor strict limitations with regard to the time for demolishing the old bridge in successive halves and moving the new sections in to replace them. Other clauses required certain tracks to be kept open for regular train movements. Briefly the contractor was allowed 72 hr., after starting demolition of the old bridge to get the north section of the new bridge into place and ready to carry railroad traffic, while for the south section the time limit for moving and restoration of service was 48 hr.



TEMPORARY WOOD PILE BENTS support east end of old bridge after abutments had been removed to permit street widening. One of new girders has been lowered on to falsework.

Work had to conform to PWA regulations limiting labor to a 30-hr. week. At first the contractor employed two shifts of 6 hr. each during 5 days of each week. This schedule was later changed to provide for each worker three 8-hr. shifts and one 6-hr. shift per week. Labor was classified in three groups with minimum hourly wages as follows: Skilled labor, $1.20; intermediate labor, $0.65; unskilled labor, $0.40.

Personnel — For the Central Railroad of New Jersey, A. E. Owen, chief engineer, the work was designed and supervised under the direction of Joseph J. Yates, bridge engineer, and C. M. Titsworth, resident engineer. For the Tuller Construction Co., of Red Bank, N. J., J. D. Tuller was in charge, with J. C. Kestler serving as superintendent, C. P. Beyland, engineer, and Henry Gally, junior engineer and timekeeper.

TUNNELS AND STREAM CROSSINGS

Intersperse Open-Trench Sections of 4-Mile Sewer

A SCORE of stream crossings and a dozen tunnels (in rock, earth and railroad embankments) obstructed the straight progress of open trench construction by the J. A. Laporte Construction Co., Inc., of New York City, in laying 4 miles of 18-to 27-in. precast concrete pipe sewer for Arlington County, Virginia. Channel changes, sand-bag cofferdams and corrugated metal pipe flumes took care of water at the stream crossings. Timber sets supported the roofs and side-walls of the man-height tunnels in earth and embankment. In the rock tunnels, trench jacks were used to support bad ground.

Trench Excavation — Most of the open trench was cut in firm rock covered with 3 or 4 ft. of earth overburden to a depth of about 16 ft. below the surface of the ground. Both in the trench and in the rock tunnels the drilling crews used hand-held drills and detachable bits. Air for all drilling operations was supplied by one stationary and six portable compressors.

Pumping equipment on the job consisted of eighteen gasoline-powered pumps, six of which had 6-in. discharges. Various combinations of pumps were used at different points in removing water from tunnels and open-trench sections of the project.

Two Lima power shovels equipped with Page 1¼-yd. back-hoe attachments dug most of the earth and broken rock out of the trenches. In close quarters where these machines could not operate the contractor used a Byers Bearcat crane with a clamshell bucket. One of the back-hoes had a standard Page tubular boom and digging arm. The other back-hoe attachment consisted of a tubular boom and a special trussed digging arm.

BACKFILL *(right)* first is placed by hand to depth of 2 ft. above pipe. Trench then is flooded with water which is allowed to stand for 24 hr. before pipe is tested for leakage.

SEWER crosses stream under railroad bridge. Corrugated pipe culvert 30 in. in diameter supported by suspender from bridge carries stream temporarily.

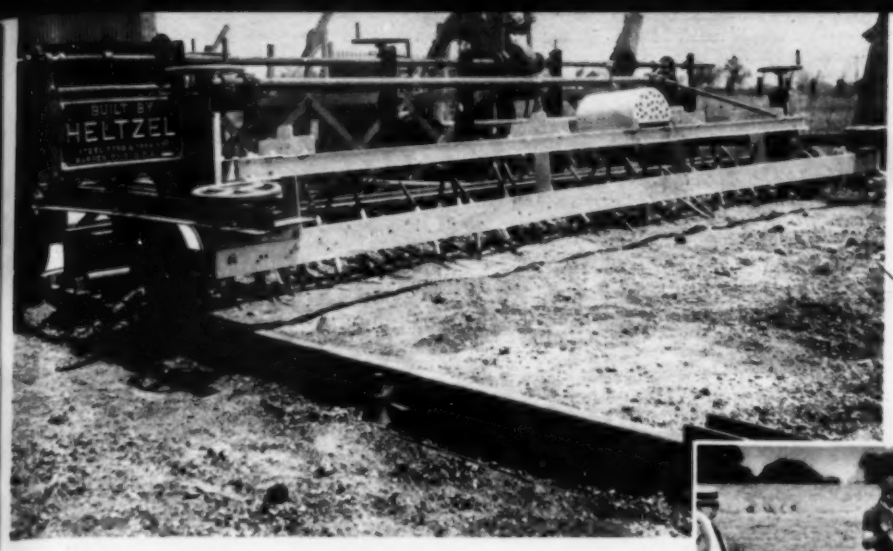
TUBULAR FRAME equipped with chain hoist lays precast concrete pipe in trench.

TRUSSED DIGGING ARM *(left)* on tubular boom is feature of back-hoe attachment on one power excavator.

Buckets of the back-hoes were fitted with special manganese steel teeth for digging rock. The machines traveled throughout the length of the contract on timber pontoons which furnished a level base for the crawlers and also served as blasting mats, being held by the back-hoes or by the crane about 6 in. above the surface of the rock. Using timber mats for blasting eliminated the short-circuiting and wire breakage sometimes caused by wire-rope mats.

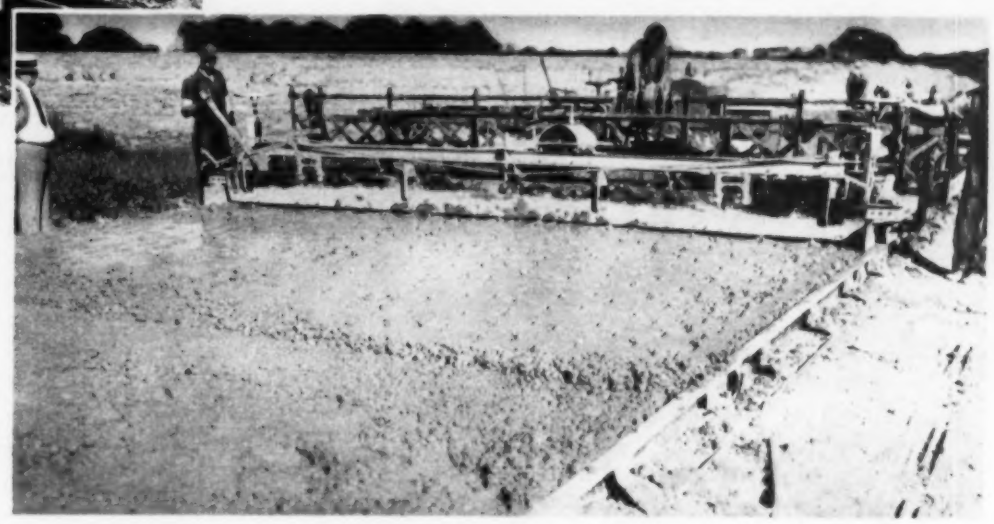
Pipe Laying — A welded tubular A-frame in the trench took the place of a crane in laying pipe. The A-frame was equipped with a Yale & Towne 1-ton spur-geared chain block which required only one man exerting a 76-lb. pull to set 4-ft. pipe sections weighing 1,200 lb. Pipe joints were sealed with grout containing Incor high-early-strength cement, the grout being placed in Weston metal joint forms. Any leaking joints revealed by test were sealed with Sika, which the contractor found to be excellent for this purpose.

Progress and Personnel — Starting work Dec. 27, 1934, the contractor completed the job in less than 12 months. Joseph A. Laporte personally directed operations for the J. A. Laporte Construction Co. The J. N. Chester Engineers, of Pittsburgh, consultants for Arlington County, Va., on this project, were represented in the field by A. T. Lundberg, resident engineer. H. T. Massey was resident engineer-inspector for PWA, which financed the construction by loan and grant.



Finishing Machine ATTACHMENT

Vibrates Concrete Slab Internally



FREELY ROTATING SPIKES *(above)* **mounted on vibrating shaft of finishing machine attachment vibrate pavement concrete internally.**

PENETRATING FRESH CONCRETE *(right)* **to depth of 5 in., 150 vibrating spikes consolidate pavement slab and eliminate need for spading along forms.**

A FINISHING MACHINE attachment which vibrates pavement concrete internally received its first field test on a section of 9-7-9 in. by 20-ft. slab constructed for the Ohio Department of Highways on State Route 14 at North Benton, in Mahoning County, by the Erie Contracting & Excavating Co., of Cleveland. The contractor attached to the front end of the finishing machine a vibrating unit mounted on coil springs and rubber-tired wheels. This attachment vibrated and consolidated the concrete by means of a large number of pointed bars, or spikes, which penetrated the plastic mass to a depth of 5 in. below the surface.

Vibrator Design—A structural frame supports a master vibrator and a transverse shaft on which are mounted the pointed vibrating elements that enter the concrete. The vibrator imparts vibrations to the spring-mounted carriage and through it to the transverse shaft on which the toothed vibrating elements are supported. These teeth are set into sockets welded to independent steel sleeves, each about 2 ft. long, which are free to rotate on the shaft. As the finishing machine moves forward or back, the serried rows of spikes, numbering 150 in all, are free to enter and leave the concrete. The entire vibrating unit can be raised or lowered as required by turning two vertical screws, one at each end of the rigid frame. Spacing of the spiked vibrating elements assures internal vibration by one element for each 100 sq. in. of pavement area.

Operation — Finishing was done by a reciprocating screed on the mechanical finisher immediately behind the vibrator attachment. Even with concrete having a slump of only ¼ in., the internal vibration of the plastic material brought sufficient mortar to the surface to produce a satisfactory finish. Although designed for use with any standard make of finishing machine, the vibrator on this initial test was attached to a Heltzel finisher constructed to operate effectively in either direction. The attachment was developed by the Heltzel Steel Form & Iron Co. On this project the finishing machine made two passes forward and one in reverse. The vibrator was kept in operation throughout the entire cycle. Spading along the side forms was entirely eliminated. The edges of the slab revealed no honeycomb nor voids of any kind when the forms were stripped. Cores removed from the pavement likewise showed an absence of voids.

ASPHALT MIX

Prepared in Concrete Mixer

ON 12 MILES of highway in a semi-arid district, the Texas State Highway Department placed 4 in. of limestone crushed to a maximum size of 1 in. on a 12-in. base of stone previously distributed from roadway cuts and sledged during grading operations. The crushed material was placed to fill the voids and to provide a suitable riding surface. Under traffic a portion of this crushed material entered the voids of the sledged stone, and a portion set up on the road. After 4 months' service, during which the surface was well maintained by blading, it was estimated that there was sufficient loose material to produce an asphaltic wearing surface 20 ft. in width and 1¼ in. in depth. A considerable proportion of the dust and finer particles had been removed from the material by traffic and wind.

Loose material on the surface was windrowed, loaded in trucks and hauled to convenient locations where it was placed in a concrete mixer with addition of 10 per cent of limestone rock asphalt, pulverized to pass a 10-mesh screen, and about 22 gal. of cutback asphalt per cubic yard of material, mixed, and returned to the road by the same trucks which had made the haul to the plant. Any deficiency of crushed material was made up from a stockpile previously provided at each mixing point. Base preparation and prime coat, made before placing the mixed material, and spreading and rolling operations were carried out in the customary manner.

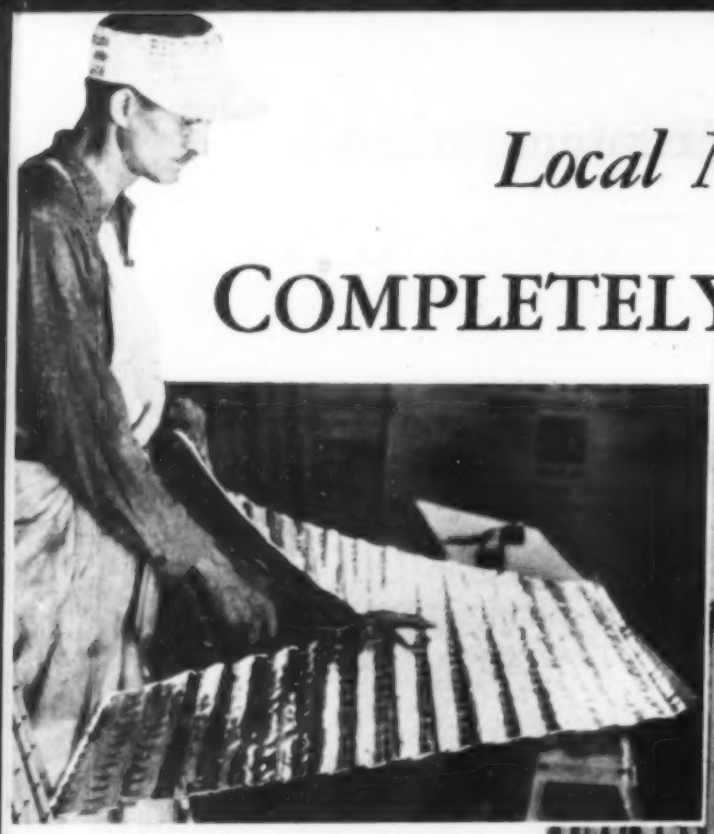
By using excess surface material and taking advantage of the two-way haul of the trucks, pavement was laid at a cost of 17¢ per square yard.

MIXING PLANT *(right)* **set up along highway mixes loose stone from roadway surface with asphalt cutback and returns material to trucks for delivery to construction crew laying asphaltic mat.**

COLD-MIX ASPHALTIC CONCRETE *(left)* **is spread and rolled to form smooth surface mat on base of napped and crushed rock.**

Local Men Design and Build

COMPLETELY ENGINEERED HOUSES



ALUMINUM FOIL cemented to one side of lathing fabric provides insulation by its high reflective power when facing air space.

A HOUSE designed and built in accordance with specification standards of a large manufacturer of materials and equipment recently went on the market at Teaneck, N. J., a suburb of New York City, where it was erected by John A. Baldwin, a local real estate operator and builder. The house is one of a number constructed recently by Mr. Baldwin and other builders in the eastern part of the United States under a plan of the Reynolds Corp., the manufacturer, by which engineered modern homes are produced through normal, existing local channels embracing the architect, builder and dealer. Within the limits of the specification standards the plan allows full liberty in design to the owner and architect. All supplies and equipment are sold through local dealers.

Design Features — Under the manufacturer's plan three sets of construction specifications are available, providing in varying degree for metal framing, insulation and air conditioning. The house under consideration was built in accordance with the complete specifications calling for application of all three features.

Structural frame and floors of the house are shrink-proof, termite-proof and highly fire-resistant. Walls, roof and floors are insulated against heat and cold. The house is heated and cooled by fully conditioned air. In addition to these features, the specifications called for the highest construction standards throughout the house.

Description of House — Architecturally, the house follows the Early American style, with a main portion three stories high to which is attached a two-story wing containing a two-car garage. The roof is slate and the siding consists of red cedar shingles painted white. The design provides seven rooms, three baths, a lavatory and two porches, in addition to a breakfast room and a basement game room. Total floor area, including the basement and garage, is a little more than 3,000 sq. ft.; cubical content is nearly 27,500 cu. ft. Standing on a lot with a 75-ft. frontage, valued at $3,000, the house is offered for sale at $15,000.

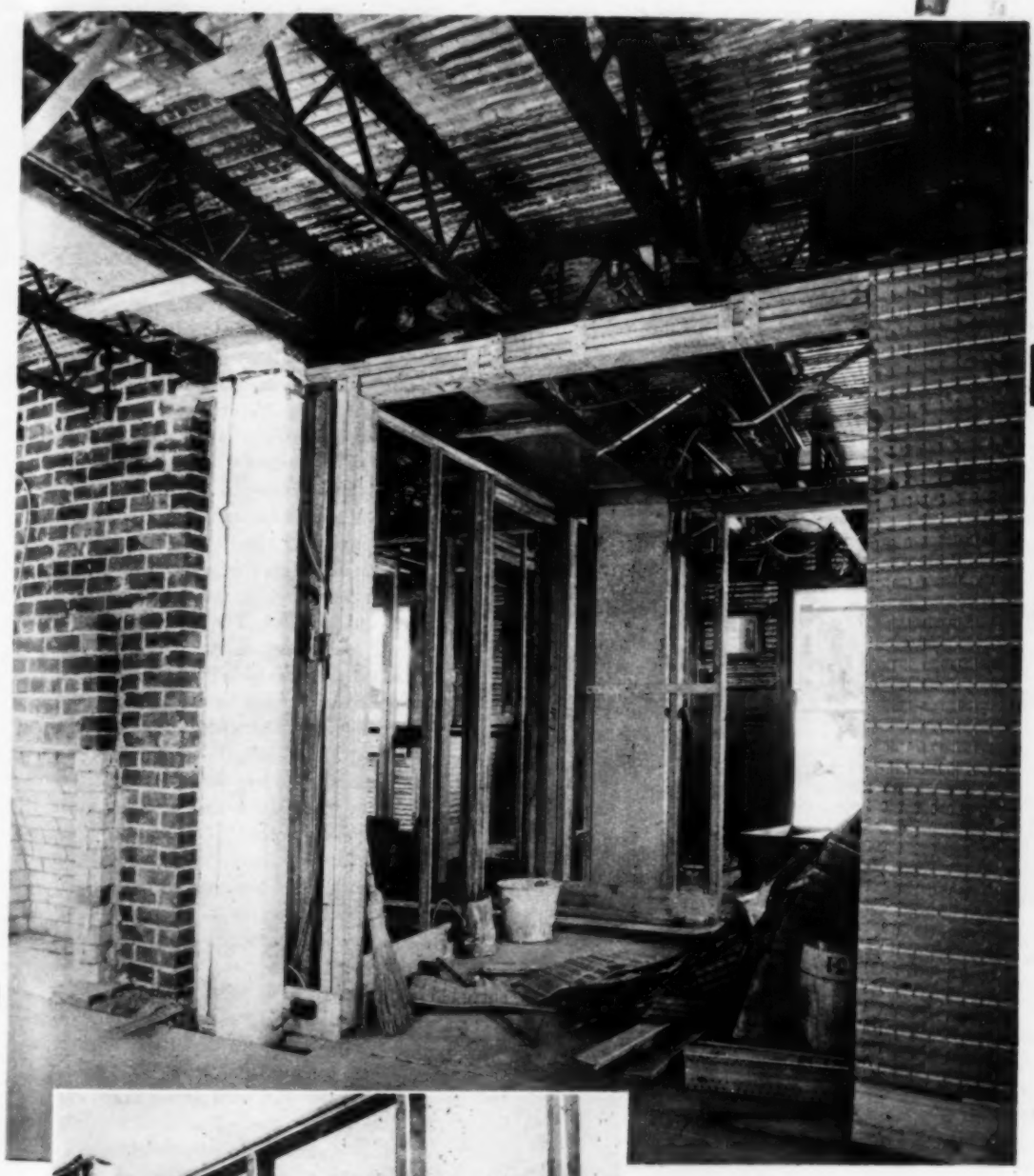
Framing and Floors — In accord-

FIREPROOF FRAME of metal-clad members filled with incombustible nailing material goes together as if it were wood frame, carpenters driving nails in sills, studs and plates. Members are marked for position in frame.

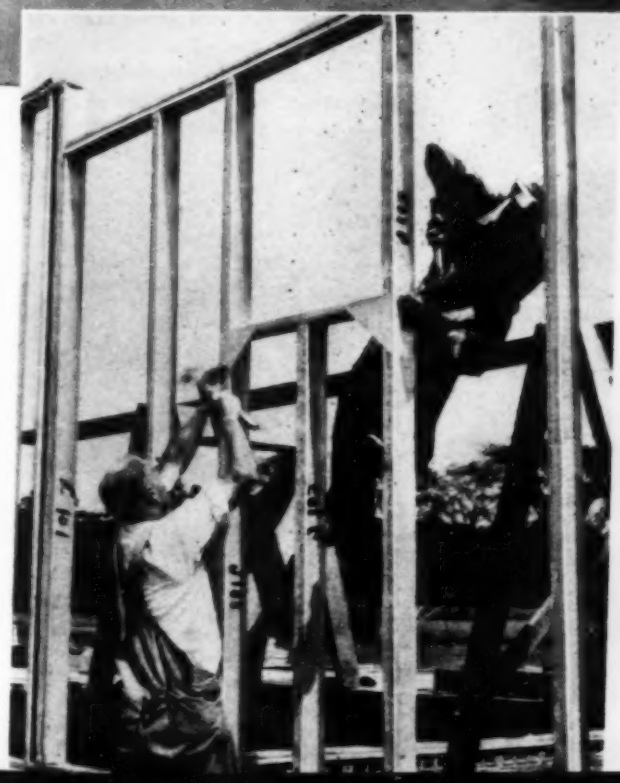
BRIDGING STRIPS *(right)* of steel plate are nailed to flanges of open-web welded steel joists. Flanges contain imcombustible nailing material sheathed in metal.

ance with the procedure adopted by the Reynolds Corp. to assure coordinated engineering design of houses using its products, the detailed plans of the various elements (structural, plumbing and air conditioning) supplied by this manufacturer to the Baldwin unit in Teaneck were begun only after the architect, J. Norman Hunter, had submitted his architectural drawings. Working from these drawings, Reynolds' engineers developed the framing plan and drew up a bill of materials detailing the dimensions of structural members for the factory, which then cut plates, studs and joists to the specified lengths. Similar procedure was followed in developing coordinated plans for plumbing and air conditioning, and in ordering the factory-produced units for these mechanical elements of the house.

Carpenters erected the flame-proof metal frame of the house in much the same way that they would have erected a wood frame. Plates and studs are metal-clad members filled with an incombustible nailing material. Welded open-web floor joists likewise have upper and lower flanges containing some of the same nailing compound incased in steel. The carpenters anchored the sills to the basement walls and toe-nailed the studs to the sills in the same way that they would have secured the parts of a wood frame.



INTERIOR of Reynolds specification house reveals open-web steel joists, fireproof floor slabs, metal framing members, lathing fabric, air ducts, plumbing pipes and wiring conduit.



METAL GUSSETS *(left)* reinforce framed openings in wall

CARPENTER knocks metal-clad stud into position for nailing. No special training is necessary for erectors of frame.

Studs measure 1¾x4½ in. in cross-section. The longer of these two dimensions is made concave on both sides of all studs except those at doors, windows and corners; the latter studs have one flat side. The concave shape of the studs reduces the thickness in the center to about ⅜ in. and produces a vertical member of lighter weight and greater stiffness. Plates and sills have rectangular cross-sections of 2x4½-in. dimensions.

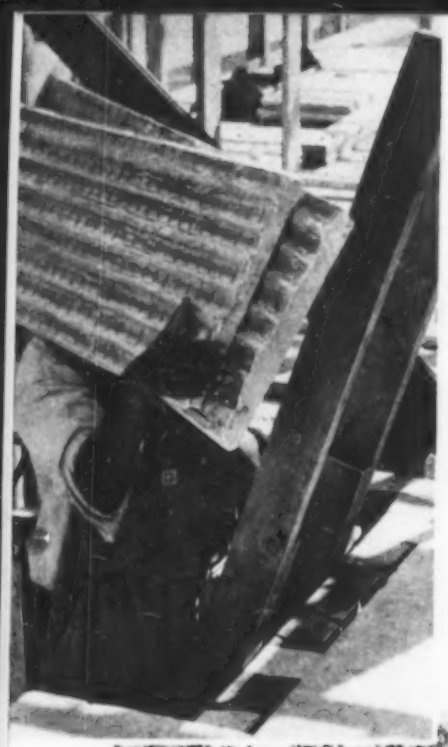
Studs and floor joists were erected on 2-ft. centers. Floor joists were bridged every 8 ft. with a steel band 2 in. wide. To the upper flanges of the floor joists were nailed incombustible precast floor slabs of light-weight cement-bound composition 1¾ in. thick by 15½ in. wide and 4 ft. long. The slab is reinforced with longitudinal steel bars, embedded in the mixture and, on the bottom side, with a welded wire mesh supporting a backing of heavy kraft paper. A workman could carry two floor slabs with ease.

Insulation — To minimize heat transmission and loss through exterior walls, roof and ceilings, these parts of the house are insulated with aluminum foil cemented to waterproof kraft paper. Laboratory tests and experience have shown that a bright metal surface will reflect 95 per cent of the radiant heat waves that come in contact with it, when facing an air space. It is stated by the U. S. Bureau of Standards that 50 to 80 per cent of heat loss from houses is by radiation. Bright metal insulation properly installed can stop nearly all of this loss. Proper insulation requires that the bright metal surface should face an air space at least ¾ in. wide.

For permanent insulating efficiency the insulation is made from aluminum of the highest purity. The aluminum foil used is of paper thinness, to eliminate absorption and storage of heat within the insulating material, winter or summer. Its light weight also makes for ease in handling and application.

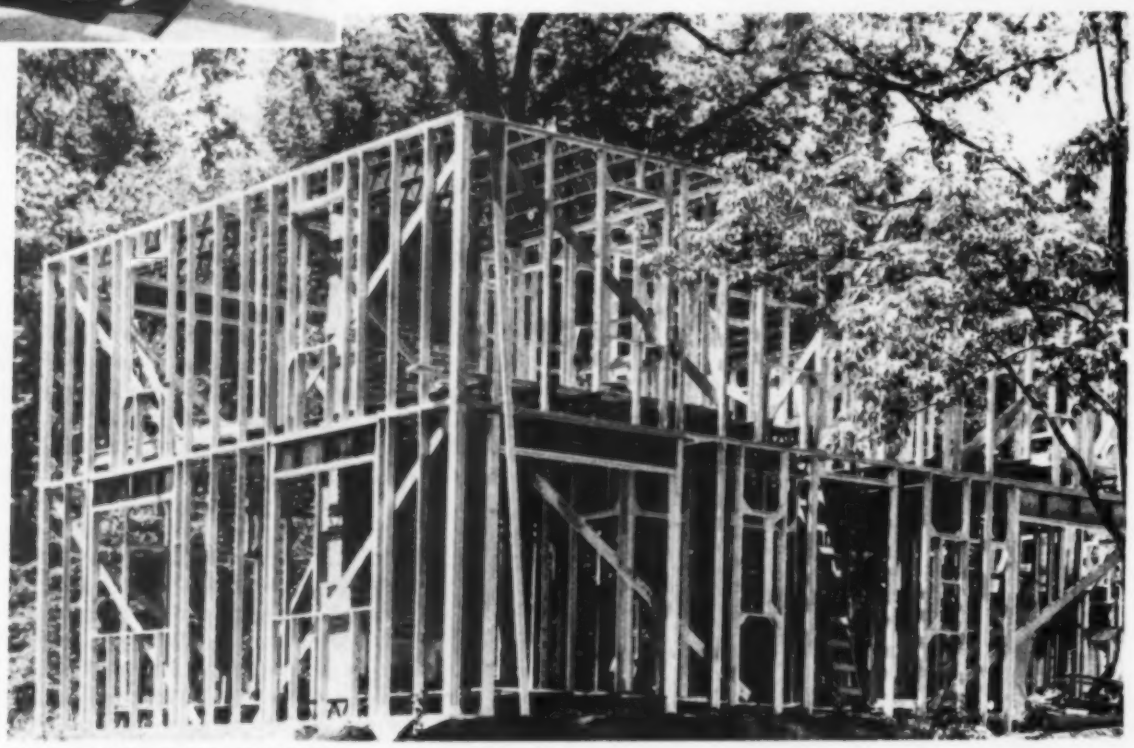
For exterior walls, floors and ceilings the aluminum foil is cemented to one side of a welded wire reinforced fabric to form a lathing base for plaster, stucco or brick veneer. Floor slabs backed by this fabric, with cross wires woven through heavy waterproof kraft paper welded to steel ribs embedded in the slab, were laid on open-web steel joists in the first and second floors. The third floor and roof are ordinary timber-frame construction.

In the exterior walls, this welded wire lathing fabric was used as a plaster base with the aluminum foil surface facing



SHIP-LAP FLOOR SLABS *(left)* of structural gypsum cast on lathing fabric and reinforced with steel bars are light enough to be carried two at a time.

LATHING FABRIC *(right)* consisting of V-stiffened welded wire mesh woven through waterproof kraft paper provides good bond for mortar backing behind brick veneer.



WALL AND FLOOR FRAMING of incombustible metal units provides rigid fire-resistant skeleton for house.

and connected to it by copper tubes is a compressor which cools, dehumidifies and circulates the air in warm weather.

Standard air conduits made up of prefabricated sections of galvanized sheet steel connect the air conditioning units with unobtrusive grills set in the walls of each room. The standard duct sections include straight runs, turns and reduction units adaptable to a distribution system for any house. Special snap locks used to assemble duct sections and fittings make rigid, air-tight joints without need of solder or sheet metal screws. Main conduits have been standardized at 8-in. depth to assure efficient air flow and ample headroom in the cellar. The size of wall stacks has been adjusted to facilitate installation in ordinary stud construction.

Construction Standards — Foundation walls were built of concrete blocks, with a full finished plastered basement. The basement floor is 5-in truck-mixed stone concrete on a cement-bound gravel subgrade.

As has been mentioned already, the third floor and roof framing were ordinary timber construction, and the roof consists of first-grade Bangor slates laid on 30-lb. Ruberoid paper on the roof boards. All flashing, leaders and downspouts are 16-oz. copper. Exterior walls have diagonal sheathing of No. 1 fir covered with 30-lb. waterproofed tar paper faced with 24-in. Colonial red cedar shingles laid 10-11 in. to the weather.

All doors, both interior and exterior, are solid pine. Windows have wood frames and double-hung sash, are fully weather stripped, and are of a patented reversible type which permits the sash to be revolved about a horizontal axis for cleaning. Walls, ceilings and partitions were given a three-coat plaster finish on paper-backed wire-mesh lath. The first and second floors have 7/8-in. t. & g. first-grade Appalachian oak flooring laid on paper on the composition floor slabs. Yellow pine on a subfloor of boards was laid on the timber joists of the third floor frame. Bathrooms and lavatories have tile floors and walls; the kitchen has inlaid linoleum floor and tiled walls to wainscot (4½-ft.) height. Interior woodwork received three coats of paint — filler, flat and enamel. The outside of the house was given three coats of white lead. All plastered ceilings were given three coats of paint, and the walls were covered with first-grade washable wallpaper.

Plumbing units, designed and factory-cut to fit the house, utilized brass piping exclusively. All electrical wiring was inclosed in standard BX cable. Hardware trim is solid brass.

Architect and Builder — J. Norman Hunter was the designer of the house and John A. Baldwin was the builder. The house is the outstanding unit of a real estate development by Mr. Baldwin featuring a number of smaller houses ranging in price from $7,000 to $9,000. In the smaller homes Mr. Baldwin has applied in lesser degree the same structural and insulating principles which he incorporated so extensively in the $15,000 house.

the air space between the studs. The roof was insulated by nailing to the bottoms of the wood rafters insulating material with aluminum foil surfaces facing two ways, up toward the roof boards and down toward the ceilings of the third-story rooms. Aluminum-foil insulating material is waterproof — losing none of its efficiency because of moisture absorption, termite-proof, vermin-proof and odorless.

Heating and Cooling — Following the design by the manufacturer's engineers of an air-conditioning system utilizing standard parts and fitting into the architect's plans, the complete list of parts for the entire system was ordered from the factory for shipment to the job. The business, of course, originated with the local dealer, who handled all orders for equipment and supplies. An air-conditioning unit containing an oil burner, heat exchanger, motor, fan, filter and cooling coils was installed in one room of the basement. Separate from the air conditioning unit

COMPLETED HOUSE at Teaneck, N. J., incorporates all features of single manufacturer's specifications for framing, insulation and airconditioning.

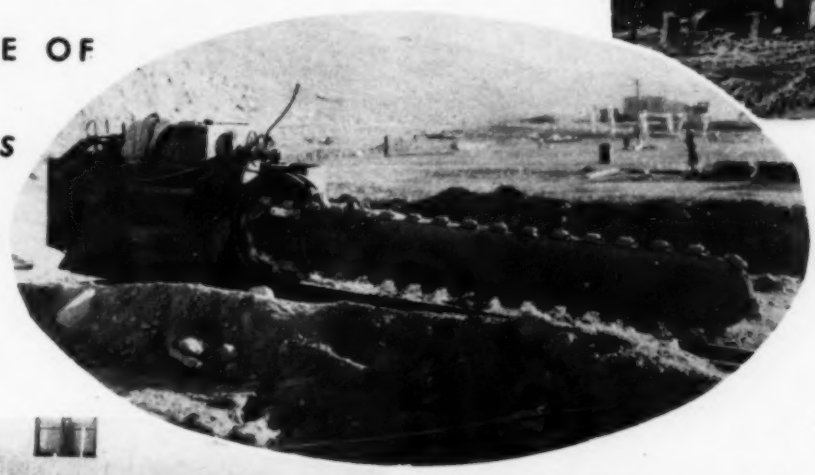
42-TON UNITS of precast concrete pressure pipe ranging from 12 ft. 8 in. to 10 ft. 8 in. in diameter for upper feeder of Metropolitan Water District distribution system in California, connecting at Cajalco reservoir with main aqueduct from Colorado River, ride on trailers of 45- to 50-ton capacity from casting yard to trench, where they are handled into ditch by steam-powered gantry crane which straddles excavation.

JOB ODDITIES

A MONTHLY PAGE OF

Unusual Features

of Construction

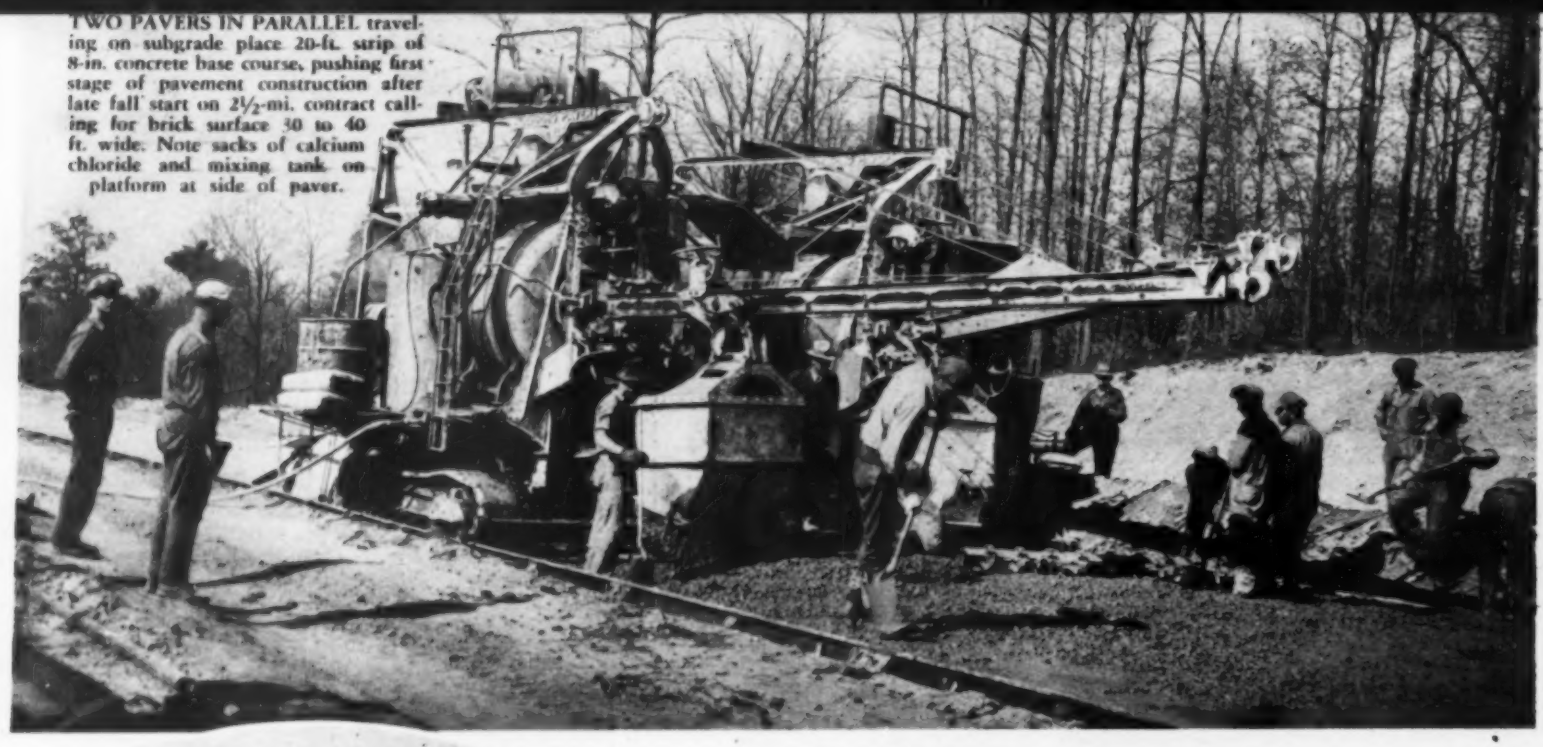


GREAT LAKES EXPOSITION at Cleveland, Ohio, formally enters advanced stage of construction with ceremonious raising of first group of four steel pylons 70 ft. high for automotive building 541 ft. long by 228 ft. wide. Eight groups of four pylons each mark outline of this building, which is one unit in great industrial exposition to be open from June 27 to Oct. 4 on mile-long site facing Lake Erie.

BASEMENT EXCAVATION is specialty of Ed Keeble, San Jose, Calif., who completes average job involving 280 cu. yd. in 9 hr. with Caterpillar 22-hp. gasoline tractor and Killefer 22-cu. ft. rotary scraper.

RAIL-MOUNTED SAW cuts vertical slots up to 8 ft. deep in shale overburden at spillway gate and cutoff trench at Fort Peck Dam. Developed by Sullivan Machinery Co. from standard coal-cutting saw, unit has 36 half-diamond-shaped teeth fastened to chain by set screws. Fan-cooled 80-hp. 440-v. motor supplies power. Machine propels self while sawing at rate of 33 in. per minute by winding cable on drum.

CUT DOWN TO FIT tunnel work *(below)* at TVA's Norris Dam, Austin Badger shovel with boom and dipper stick shortened 3 ft. and 1½ ft., respectively, loads muck into trucks for Nello L. Teer, contractor. Hose in foreground conducts exhaust fumes out of tunnel.



TWO PAVERS IN PARALLEL traveling on subgrade place 20-ft. strip of 8-in. concrete base course, pushing first stage of pavement construction after late fall start on 2½-mi. contract calling for brick surface 30 to 40 ft. wide. Note sacks of calcium chloride and mixing tank on platform at side of paver.

POWER SUBGRADER riding on road forms trims fine grade to accurate profile for first 20-ft. strip of concrete base. Machine propels itself by two power winches which wind up cables anchored to forms ahead of unit. Steel-plate ramps carry batch trucks across subgrader.

TWIN PAVERS

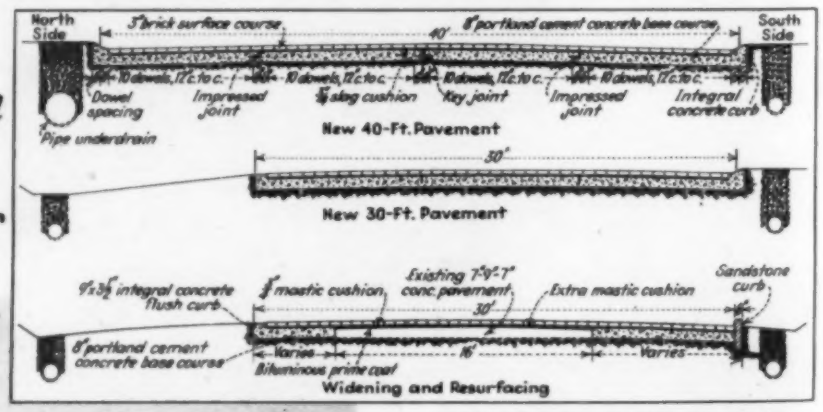
Push Concrete Base Construction With Aid of Admix-Accelerator

SPECIFICATION of calcium chloride admixture and operation of two paving mixers side by side late last fall speeded construction of concrete base for a brick paving project on Ohio State Route 18 about 15 mi. west of Akron. The contract called for construction of 2.528 mi. of pavement 30 to 40 ft. wide and the widening of one bridge. Starting construction of 8-in. base at the east end on Oct. 17, Beightler & Hussey, of Columbus, Ohio, the contractors, operating two paving mixers side by side between the forms, laid a 20-ft. slab for 11,700 lin. ft. to the corporation limit of Medina. Inside the corporation limit the contract called for a 1,657-ft. extension of the improvement consisting principally of widening and surfacing existing 16-ft. slab to make 30-ft. brick pavement.

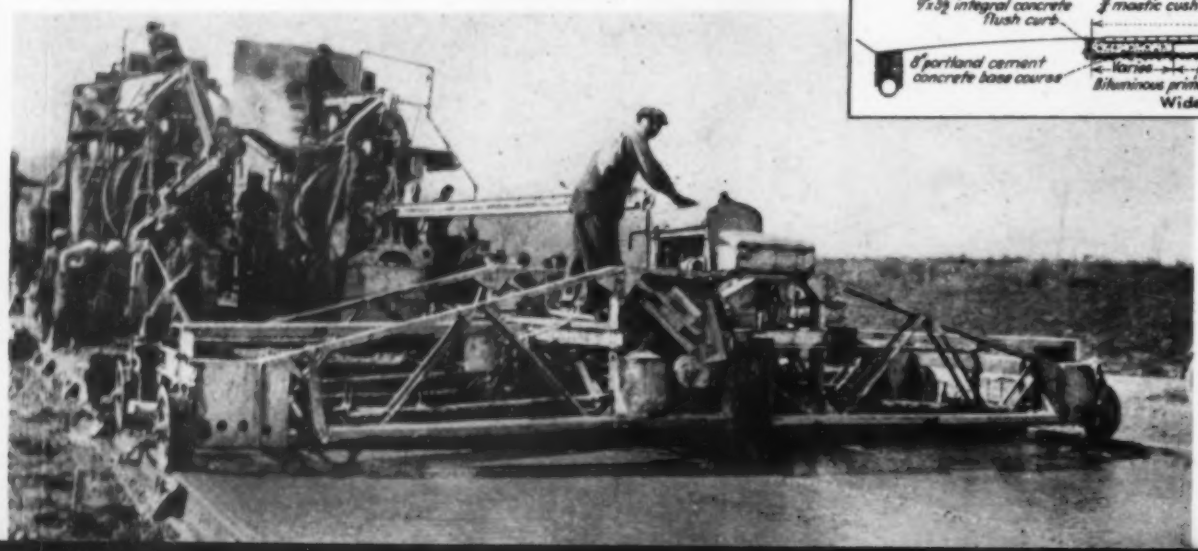
Calcium chloride solution added to the concrete mixture at the rate of 2 lb. of calcium chloride to each 100 lb. of portland cement accelerated setting and curing and dispensed with need of sprinkling during the curing period. The twin-mixer team produced more concrete than could have been mixed by a single paver, but a shortage of batch trucks, supplied by a separate concern under subcontract, prevented the paving organization from reaping the full benefit of the dual set-up. Despite relatively high production of concrete in cool weather, the acceleration in setting induced by the calcium chloride admixture enabled the finishers to work within 200 ft. of the mixers and to complete the finishing within 2 hr. of the final shutdown each evening.

As the days shortened and it became necessary to run the pavers until dark, the finishers, especially on rolled curb, worked for several hours each night with the aid of two 500-w. floodlights supplied with power from a portable gasoline-generator unit.

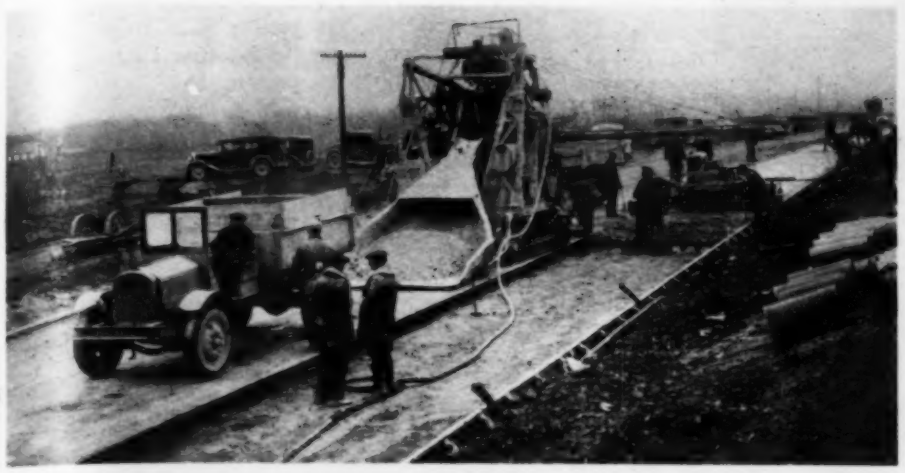
After the two pavers working in parallel had completed 2.1 mi. of 20-ft. width, one of the machines retired to the shoulder of the road and the other went ahead with paving adjacent 10-ft. lanes with rolled integral curb.



PAVEMENT SECTIONS indicate thorough drainage built into shoulders and use of integral concrete curbs of rolled and flush types. Third section, with sandstone curb, shows mastic cushion leveling course on existing pavement in borough of Medina.



WHEEL CUTTER *(left)* at rear of finishing machine opens slot in center of 20-ft. strip for construction of impressed joint.



FOLLOWING COMPLETION of 20-ft. strip of concrete base, single paver traveling on slab places adjacent 10-ft. lane. Drainage pipe is stacked on bank. Power finisher strikes off concrete.

Where the pavement is 30-ft. wide, provision is made for future widening to 40 ft. by placing 9x3½-in. flush curb along the north edge of the slab, with rolled curb on the south side only; 40-ft. pavement has rolled curbs on both edges. Pavement sections reproduced herewith illustrate these and other details of the pavement design.

As soon as beam tests of concrete placed in the final lane of the base indicated a modulus of rupture of 500 lb. per square inch or greater, the base was opened to wearing course operations. After hauling and stacking along the shoulders of the pavement a sufficient number of 3-in. wire-cut vertical fiber lug brick to take care of the surfacing, the contractor spread and struck off a ¾-in. cushion of slag screenings with the aid of disk-wheel strike-off templets. Two 20-ft. roller conveyors served a crew of four droppers who placed the brick on the slag bedding course. Just prior to filling the joints with hot asphalt dumped from pouring pots, the surface of the newly laid brick was sprayed with a lime-and-water solution to prevent the hot asphalt from bonding to the top of the brick. A few minutes later, the excess asphalt was scraped off the surface of the pavement and was returned to the kettles for re-use.

Highway Design—Ohio State Route 18 carries heavy traffic between Akron and the cities to the west. In addition to providing a wider roadway, the present improvement eases the curves and removes some irregularities from the grades. Five curves are included in the 2½-mi. contract; the greatest has a curvature of 1½ deg. The maximum grade, approaching the bridge from the west, is 6 per cent. Where sight distances are limited, as on this hill and on one other, the contract calls for construction of pavement to the final 40-ft. width. In all, the contract involves about 3,100 lin. ft. of 40-ft. width pavement. Transition sections (from 40- to 30-ft. width) are 300 ft. long. The bridge, which formerly carried a 29-ft. roadway, has been widened to 44 ft.

Base Concrete — Design of the concrete mixture for the base was carried out by absolute volume proportioning, using slag as the coarse aggregate and translating all proportions into weights for measurement at the batching plant. The batch was based on a nominal 1:7½ mix, with 4.9 sacks of cement to each cubic yard of concrete. Actually a five-bag batch was used, yielding 27.54 cu. ft. per batch. Moisture content was limited to 7½ gal. per sack of cement, including the 2 per cent solution of calcium chloride and the moisture in the aggregate. Each batch received 10 quarts of calcium chloride solution.

Slag aggregate was batched in two sizes, No. 4 up to ¾ in. and No. 3 up to 1½ in. Typical batch weights for aggregate, including the moisture in the aggregate, are those for Oct. 31, as follows: ¾-in. slag, 880 lb.; 1½-in. slag, 998 lb.; sand, 1,420 lb. These weights were for a five-bag batch.

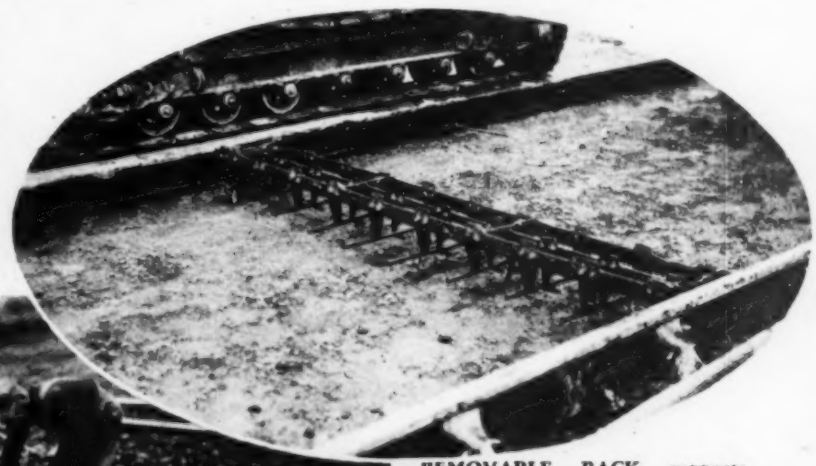
A longitudional doweled contraction joint divides the 20-ft. concrete slab placed by the twin pavers into two 10-ft. lanes. These lanes and adjacent lanes placed later are tied together with ½-in. dowel bars 5-ft. long placed on 5-ft. centers. Before fresh concrete was placed against the slab already in place, the edge of the slab was cleaned and painted with asphalt. Transverse contraction joints are spaced 25 ft. apart and are doweled with ¾-in. bars 2-ft. long on 12-in. centers. A 10-ft. lane takes ten dowels, the outside bars being placed 6 in. from the edge.

Integral curbs of flush flat-top or rolled design were constructed, as indicated by the pavement cross-section. Within the limits of Medina, the design called for 6x20-in. sandstone curb along the finished south edge of the pavement. The unfinished north edge has 3½x9-in. concrete flush curb to permit later widening to 40 ft.

Fine Grading — Rough grading had been completed under a previous contract. Following some preliminary shaping of the grade, the present contractor set the road forms with the aid of a Carr form grader and completed the fine grading with an R.B. power subgrader riding on the forms. On subsequent 10-ft. lanes, the contractors used a Lakewood subgrader, which was drawn forward by a tractor. The latter subgrader also was used on superelevated curves of the original 20-ft. slab to save resetting the blades of the power subgrader.

The power subgrader trimmed the fine grade between the forms by means of a row of reciprocating blades, each about 15 in. long, across the front of the machine. The blades moved about 2 in. Earth loosened by the blades passed over them to a scraper conveyor which traveled on the subgrade transversely across the road and delivered excess material to the shoulders. The scraper conveyor left enough fine earth on the subgrade to be struck off to exact profile by a blade mounted on the subgrader behind the conveyor. Forward movement of the power subgrader was accomplished by two power winches.

To take care of the 3½x9-in. header curbs, the contractors built up Heltzel 9-in. steel road forms by adding 3x8-in. sub-rails supplied by the manufacturer. They used 4,500 lin. ft. of these forms on the contract, sufficient for 2,250 lin. ft. of initial 20-ft. width, where forms had to be set for both edges of the pavement. When con-



REMOVABLE RACK supports dowel bars at location of contraction joint until concrete is placed around them. Hooked fingers under dowels then are slid back, and rack is lifted from concrete.

JOINT CUTTER for transverse contraction joints has sawtooth cutting edge. Device is pushed down into concrete and moved back and forth by means of pipe handles. In background, workmen are placing steel rails for rolled curb.

AFTER CUTTING SLOT *(below)* for contraction joint, two men install remolded asphalt mastic joint filler across concrete slab.

SUB-RAIL *(left)* under ordinary steel road form increases height for construction of integral flush curb.

ADDITIONAL CONCRETE *(left)* for rolled curb is placed by hand from wheelbarrow. Special screed on finishing machine leaves some concrete banked against inside of form.

structing 12x7½-in. rolled curb, it was necessary to attach an additional 3½-in. rail to the top of the 12-in. built-up form.

Materials Supply—A batching plant was set up by the subcontractor alongside a railroad spur in Medina, about ¼ mi. from the west end of the contract. At this plant a Moore Speedcrane equipped with a 1-yd. clamshell bucket handled sand and slag out of railroad cars into reserve stock piles or overhead bins. Two Blaw-Knox steel bins

HAND FINISHERS *(right)* guided by steel templets mold rolled curb to designed profile.

DISK-WHEEL TEMPLETS *(left)* of 20- and 10-ft. span strike off ¾-in. cushion of slag screenings for brick surface 30 ft. wide.

SURFACE HEATER *(below)* raises temperature of brick above 80 deg., F., for application of filler, as specified when temperature of brick laid in pavement is below 50 deg.

were set up in tandem, one double-compartment bin being used for two sizes of slag and the other bin being used for sand. After backing under the weighing batchers of the two bins to take on a load of aggregate, the two-batch trucks stopped beside a box car to receive five sacks of cement per batch.

Because no water was needed for sprinkling, the contractors were able to supply sufficient water for the operation of two paving mixers through a 2-in. pipe line, pumping a maximum distance of 1½ mi., about ¼ mi. in excess of the greatest distance for full efficiency of the water supply system.

Concrete Production—Specifications of the Ohio Department of Highways require that each batch of concrete shall be mixed not less than 1¼ min. after all materials are in the drum. With a mixing period of 1¼ min., it is possible for a paving mixer when operating at high efficiency to produce 40 batches an hour. As has been noted, delay in supplying materials to the mixers prevented them from attaining their full potential output. When operating side by side, the best production record of the two Koehring 27-E pavers was 528 batches in a 10-hr. day. On this day the two pavers completed 1,070 ft. of 8-in. base 20-ft. wide. By comparison, a single paver working on a 10-ft. lane at a later date, placed 315 batches in a day of about 10 hr., completing 1,127½ ft. of base, including curb.

Calcium Chloride Admixture—Calcium chloride was mixed with water in the proper proportion in two cylindrical tanks, equipped with iron paddles, mounted in vertical position on a small platform attached to the mixer frame. A pump driven by a mixer trunnion maintained a full charge of the solution in a calibrated gaging tank at the top of the mixer frame. Excess solution was returned to the mixing tank by a by-pass pipe. A valve control bar operated by movement of the mixer skip discharged the correct amount of calcium chloride solution from the gaging tank at the top of the frame into the mixer skip for each batch. When the two pavers were operating side by side, one man took care of mixing the calcium chloride for both mixers.

Addition of calcium chloride to the concrete mixture on this job was estimated by those in charge to have reduced the time required for setting by at least 20 per cent, speeding the finishing of the pavement by this amount. The calcium chloride also accelerated the development of strength in the concrete and permitted the contractors

TWO 20-FT. ROLLER CONVEYORS deliver brick to four droppers laying 30-ft. pavement at average rate of about 100 lin. ft. per hour.

to use the slab for hauling a day or two earlier than otherwise would have been the case.

Rolled Curb — For construction of rolled curb, V. N. Holderman, superintendent in charge of the contract, devised two templets of narrow, flat steel plate bent to the profile of the rolled curb. These plates rested on the steel curb forms and supported a timber screed about 6-ft. long as it was moved forward and back by two men who struck off the concrete to the profile of the templet.

Cold-Weather Concrete—When the atmospheric temperature dropped to 50 deg. F. or lower, the contractors raised the temperature of the concrete to between 65 and 85 deg. by operating a flame jet into the drum opening and running the engine exhaust through the mixing water tank. At the bridge, concrete aggregates were heated by live steam released through perforated pipes under the stock pile on the pavement, and mixing water likewise was heated by a jet of live steam and by a flame jet.

Brick Surface—Four droppers were able to lay about 100 lin. ft. of 30-ft. width in one hour. Delays frequently cut down this hourly average, but under fair conditions the four droppers were able to complete about 635 ft. in an 8-hr. day.

Asphalt to fill the joints in the brick surface was heated to between 400 and 450 deg. F. in 500-gal. Littleford kettles, of which the contractor had five on the job. Three or four kettles usually sufficed to keep the joint fillers supplied with material. Heating of the asphalt was greatly facilitated by the use of a 1,500-gal. storage tank in which the material was maintained at a temperature of about 300 deg. for delivery to the kettles as needed. Filler was hauled to the job in liquid form direct from processing vats in Cleveland.

Prior to application of the filler, the brick surface was rolled by a 5-ton tandem roller operating parallel with the center line of the pavement and working from each curb toward the center line. When the temperature of the brick was below 50 deg. F., a surface heater was used to raise the temperature to 80 deg. before the filler was poured.

Bridge Widening—As indicated by an accompanying photograph, the existing concrete beam bridge built in 1930 across Rocky River was widened by demolishing the guard rails and wing walls at both sides of the structure, extending the abutments and constructing additional beams, deck, wing walls and railing on both sides of the old bridge.

Progress — Paving of the concrete base course started Oct. 17, 1935. By Dec. 18, when the job shut down for the winter, the contractors had completed all concrete base, curb and curb inlets, in addition to 3,300 lin. ft. of brick surface at the east end of the project. Operations resumed the last week of February. By April 15 the brick crew had completed all the wearing course except two portions which required mastic cushion (leveling course) on top of old pavement,—1,657 ft. in the borough and about 900 ft. on the bridge and east of the bridge. On that date 90 per cent of the contract, which sold originally for $189,057, had been completed. Completion of the entire contract was expected early in May.

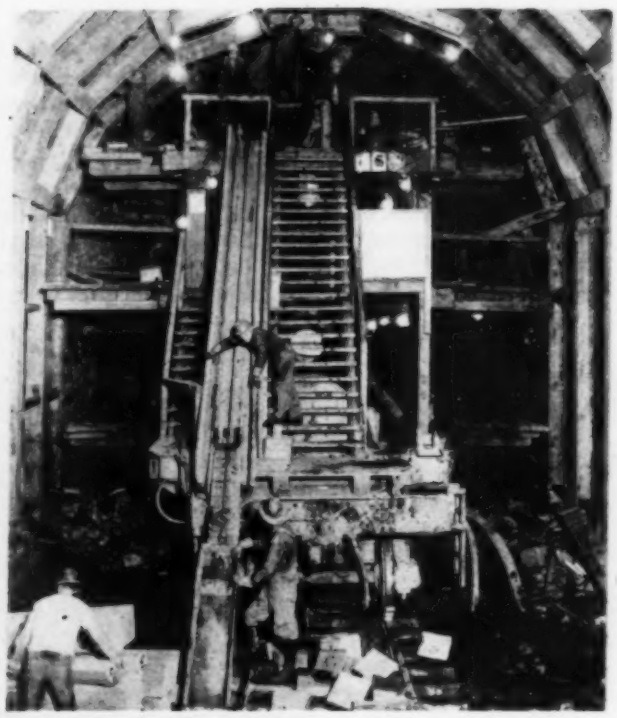
Personnel — John Jaster, Jr., is director of the Ohio Department of Highways, and Elmer Hilty is chief engineer of construction. The improvement on the Akron-Medina road was carried out under the direction of I. R. Ault, division engineer, Ashland, Ohio, and W. R. Flack, resident engineer for Medina County, with V. T. Grimes, project engineer, in direct charge of the work. For Beightler & Hussey, the contractors, V. N. Holderman, superintendent, directed operations.

AIR-PRESSURE SPRAY *(above)* **applies lime whitewash to surface of brick prior to pouring of filler.**

ASPHALT FILLER *(left)* **heated in three kettles is poured into joints of brick surface. When partially cooled, excess asphalt is stripped from surface with hand scrapers.**

CONCRETE GIRDER BRIDGE *(above)* **across Rocky River has its roadway widened from 29 to 44 ft. Crane drives steel sheetpiles with drop hammer in swinging leads, portable compressor supplies air for demolition of old railing, and boiler at left heats aggregates and water for mixing.**

SUPERVISING CONSTRUCTION *(at left)* **on project are Vance T. Grimes (left), project engineer for Ohio Department of Highways, and Verne N. Holderman, superintendent for Beightler & Hussey, contractors.**

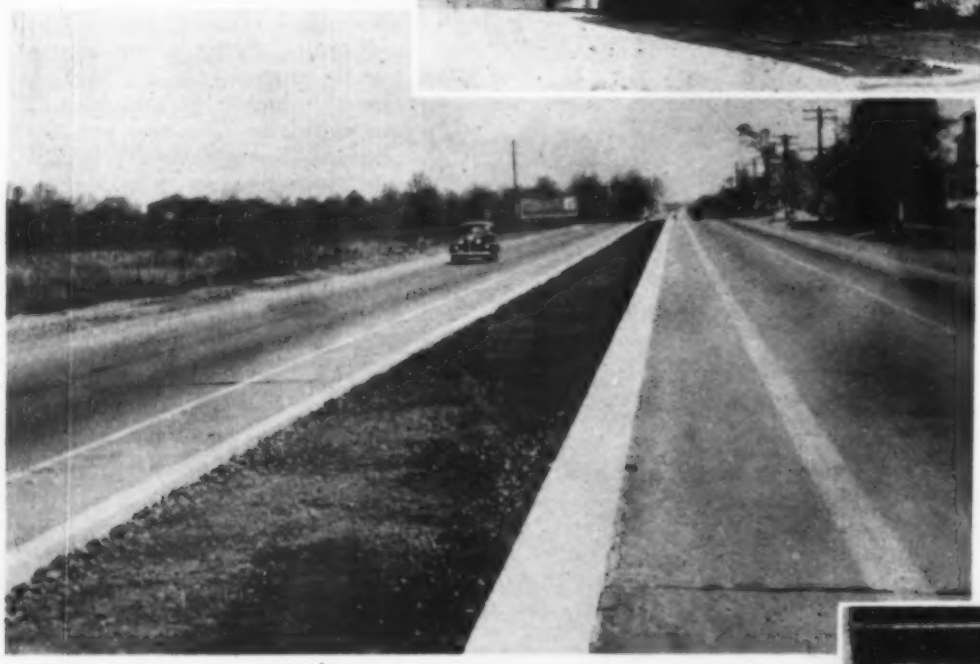


LARGE DRILL JUMBO *(right, showing rear and front ends)* used by J. F. Shea Co., under subcontract with Six Companies Inc., on 32-ft. diameter twin diversion tunnels at Parker dam on Colorado River, has working platforms at three levels and mountings for 19 drills. Jumbo is mounted on chassis of old power shovel. Wings at each platform level fold down when outfit is moved. On timber frame at front is mounted a vertical grid of piping for attachment of drills at any desired location. Horizontal drill bars are 4-in. extra heavy pipe and swivels on vertical column allow bars to swing back parallel to carriage for moving. Each drill covers about five holes by swinging on its arm and sliding along bar. Plank stairway *(shown in left of two views)* leads to upper platform levels and inclined chute *(along stairway)* served by power hoist delivers drill steel to top. One jumbo serves two tunnels and is moved back and forth on standard-gage track by 13-ton electric locomotive.

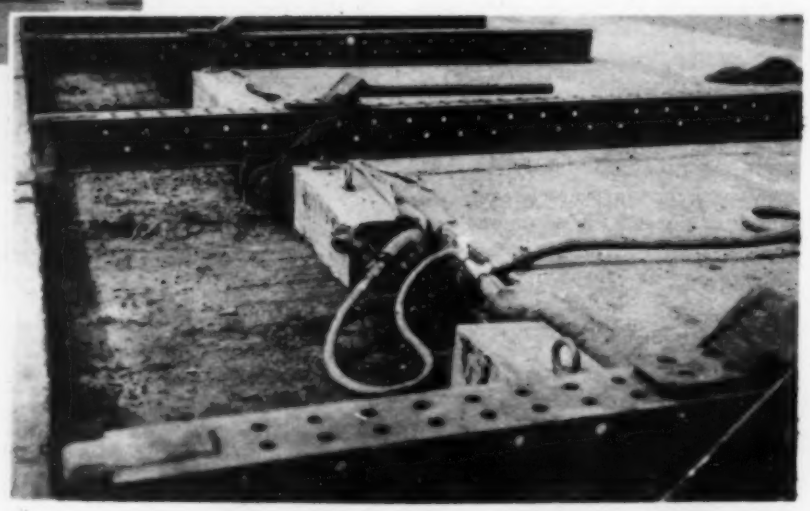
Getting Down to

DETAILS

Close-Up Shots of Job Methods and Equipment

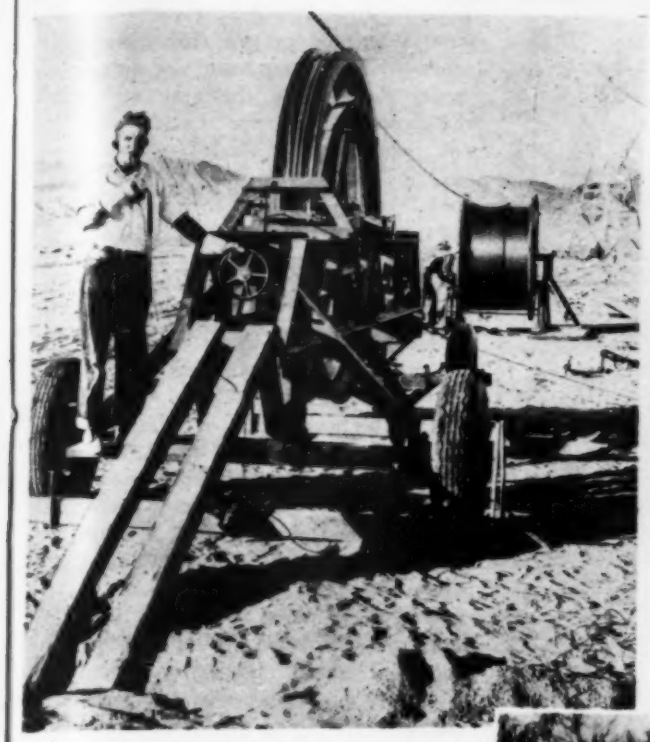


TRAFFIC-SEPARATING "ISLAND" *(above)* 12 ft. wide is formed in New Jersey's Brunswick Turnpike by shoving concrete slabs laterally with air-inflated rubber hose, as described in *Construction Methods* for January, pp. 36-39. IMPROVED STEEL STRUT *(right)* eliminates need for wood blocking originally used to transmit to slab force of thrust of air-expanded hose line.



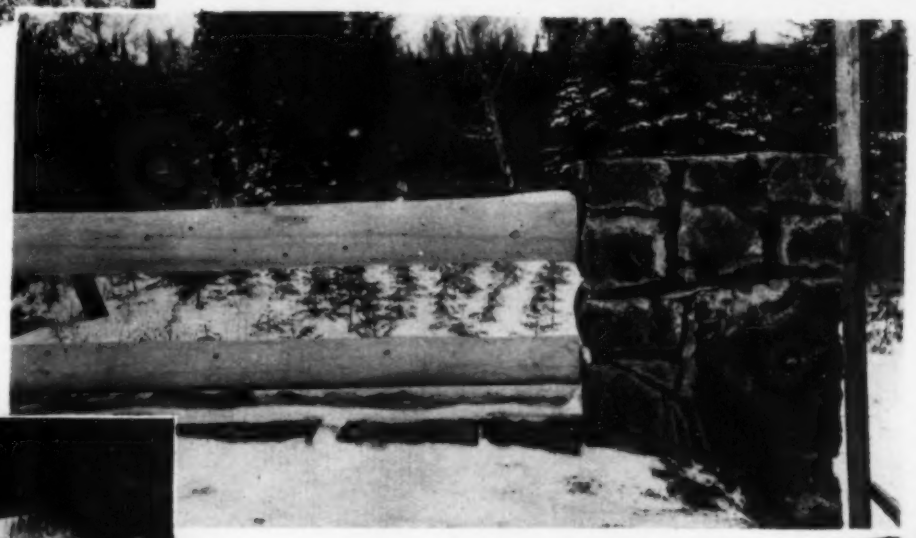
STREET LIGHTING STANDARDS GROUNDED as safety measure in event of short circuits. With crew of three men, truck-mounted compressor and air tools, Kansas City Power & Light Co. has protected 4,671 lighting standards over 3-yr. period. Two men drive 8-ft. ground wire with air hammer as third drills hole in base of standard to receive rivet-bolt connected to lead wire brazed to ground rod. Average cost per installation was $2.46 and average time 16 min., according to T. G. Hieronymus, superintendent.

SWIVEL-PIPE SPRINKLER *(below)* attached to tank truck improvised from old passenger automobile by Boxley Bros. Co. Inc., of Orange, Va., wets burlap on 11-ft. widening strip added to U. S. 1 south of Fredericksburg, Va.



CABLE STRINGING RIG on pneumatic tires builds 266-mi. electric power transmission line between Boulder dam and Los Angeles, Calif. Mobile bullwheel device regulates tension of 1.4-in. diameter tubular copper conductor, unwound from large drums, in background, and strung on arms of steel transmission towers spaced an average distance of about 1,000 ft. apart. Conductor cable length totals 1,667 mi.

BITUMINOUS SPRAY CURING *(above)* of concrete lining for canal section of Colorado River aqueduct is accomplished by Utah Construction Co. with film of coal tar cutback applied from traveling bridge. Truck along canal bank carries drums of coal tar from which hose line connects with pressure distributor in form of long pipe.



PEELED LOGS *(left)* between masonry walls form rustic guard rail, designed by Minnesota State Highway Department for culvert crossing.

HARD FACING *(left)* is applied to 3-in. disk of 600-lb. globe valve by Haynes Stellite process applied with Linde oxyacetylene welding equipment to increase resistance to wear and corrosion.

25-FT. STEEL BEAM *(above)* resting on asphaltic wearing surface of existing pavement provides uniform riding surface for inner end of manually operated templet used by R. K. Williams, Inc., of Richmond, to strike off concrete base widening on U. S. 60 at Sandston, Va. Outer end rides on steel road form.

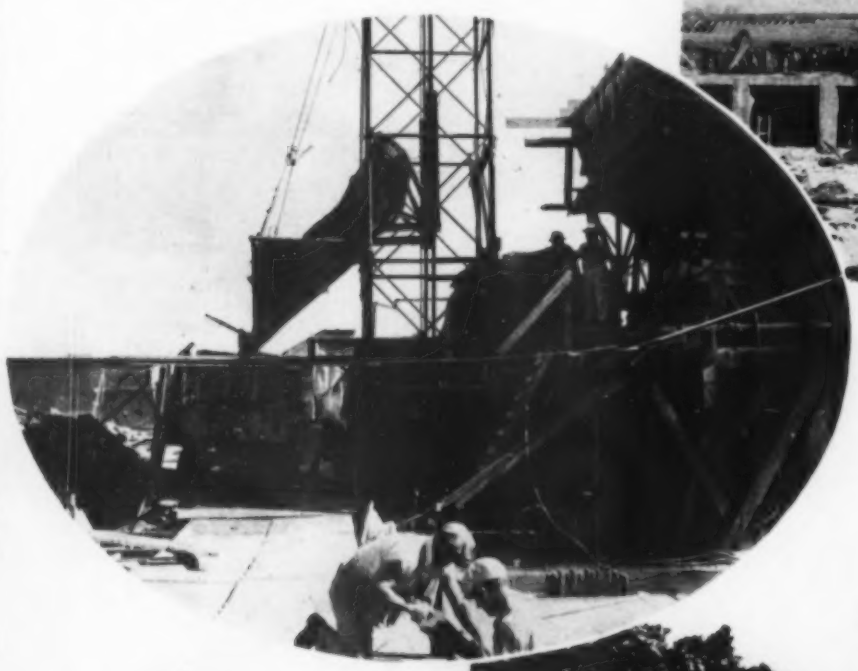
ADJUSTING STRANDS *(left)* on one of 36½-in. diameter cables of Golden Gate bridge, San Francisco, to temporary position in strand frame. Frames are spaced 400 ft. apart.

CENTRAL PLANT

Delivers Concrete to Various Levels of

CENTRAL MIXING PLANT at base of steel hoist tower furnishes 15,000 cu. yd. of concrete to all units of new water filtration plant for Reading, Pa. Truck on timber ramp above mixing plant is dumping material into bin. Pump room in basement of head house is under construction at right; foundations of filters, in left foreground.

TARPAULINS inclose work in head house during winter, permitting concrete to be placed with aid of steam and salamanders.



CONCRETE for foundations and settling basins is distributed by end-dump trucks equipped with hopper bodies. Tower hopper at low level charges trucks.

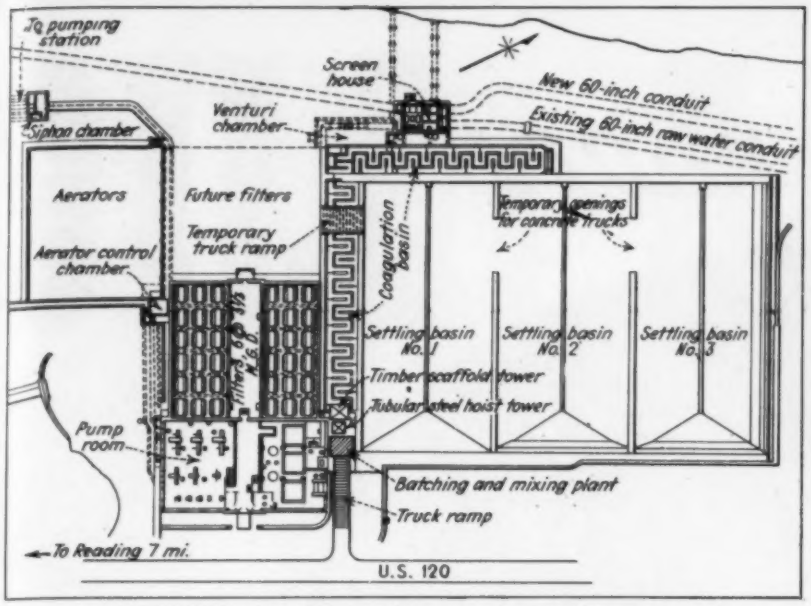
BELT CONVEYOR *(below)* elevates concrete delivered by truck to deck hopper on scaffold for placement in settling basin walls.

A CENTRAL MIXING PLANT which delivered to an adjacent hoist tower carrying hoppers at two levels produced 15,000 cu. yd. of concrete for the settling basins, filters, head house and other structures involved in the contract of William Steele Sons Co., of Philadelphia, at the new Reading, Pa., filter plant, built under the city's $2,500,000 program to provide 20,000,000 gal. a day of pure water for present and future needs. For the settling basins and foundation structures of the filter plant end-dump trucks equipped with special hopper bodies hauled concrete from the central hoist tower. A portable belt conveyor placed concrete in the walls of the settling basins, coagulation basins, aerators, and building foundations. Concrete for higher levels in the head house and filter building was discharged from the upper hopper on the steel tower to hand carts on the platforms of a timber scaffold erected next to the hoist tower.

Structural Contract — Reinforced-concrete and rubble-stone masonry construction for the entire group of structures indicated on the accompanying plan was included in the William Steele Sons contract, valued at about $440,000. Excavation in the hard blue limestone foundation rock had been completed under a previous contract. In architectural appearance the head house, filter building and screen house conform with the existing 18th century structures of the surrounding rural community, the reinforced-concrete frames being completely concealed by rubble stone facing and curtain walls. The rubble masonry, built entirely with rock from the foundation excavation, corresponds with the typical construction of nearby dwellings and barns. Masonry walls of the filter plant are 16 to 24 in. thick; the average thickness is about 18 in.

Foundation excavation extended about 26 ft. below the ground surface along the front of the head house and settling basins. The open cut offered a ready-made location for a central mixing plant to which truck-dumped materials could be fed by gravity. At the site of the filter plant's coal bin, the contractor line-drilled a vertical rock face and erected a 1-yd. mixing plant equipped with overhead bins and batchers to which trucks could deliver by backing up a short ramp from the adjacent highway, U. S. 120, in front of the filter plant. Concrete was discharged by the mixer into the tower bucket of a tubular steel hoisting tower set directly in front of the mixing plant.

Concreting Procedure — When placing concrete in foundation structures or



CONSTRUCTION LAYOUT indicates location of mixing plant, hoist tower and head-house scaffold. Note truck bridge across coagulation basin and temporary openings in dividing walls of settling basins.

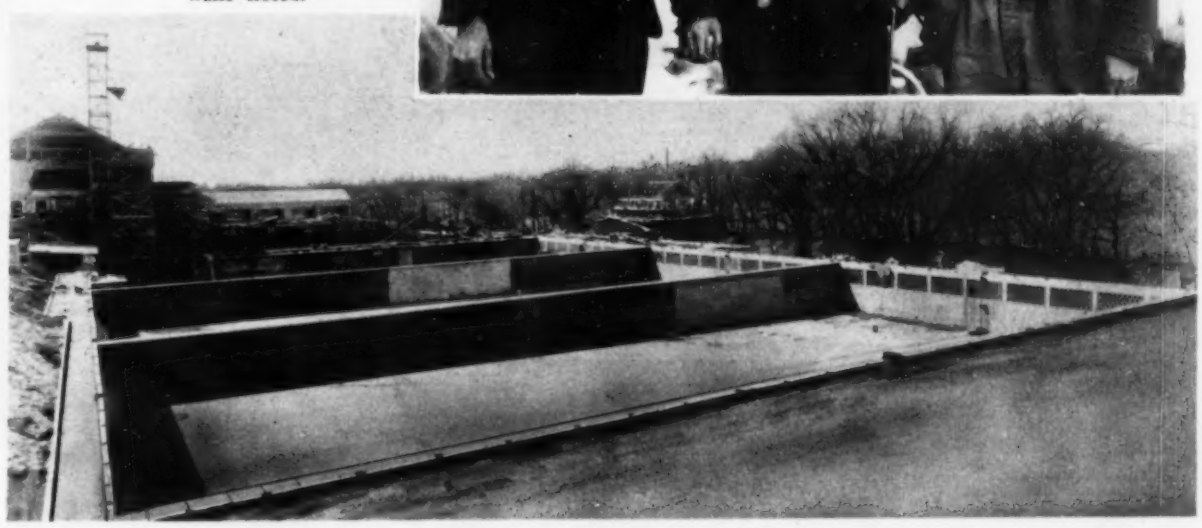
RUBBLE STONE FACING utilizing rock removed from excavation gives head house and filter building appearance harmonizing with locality. Aerator piping appears in foreground.

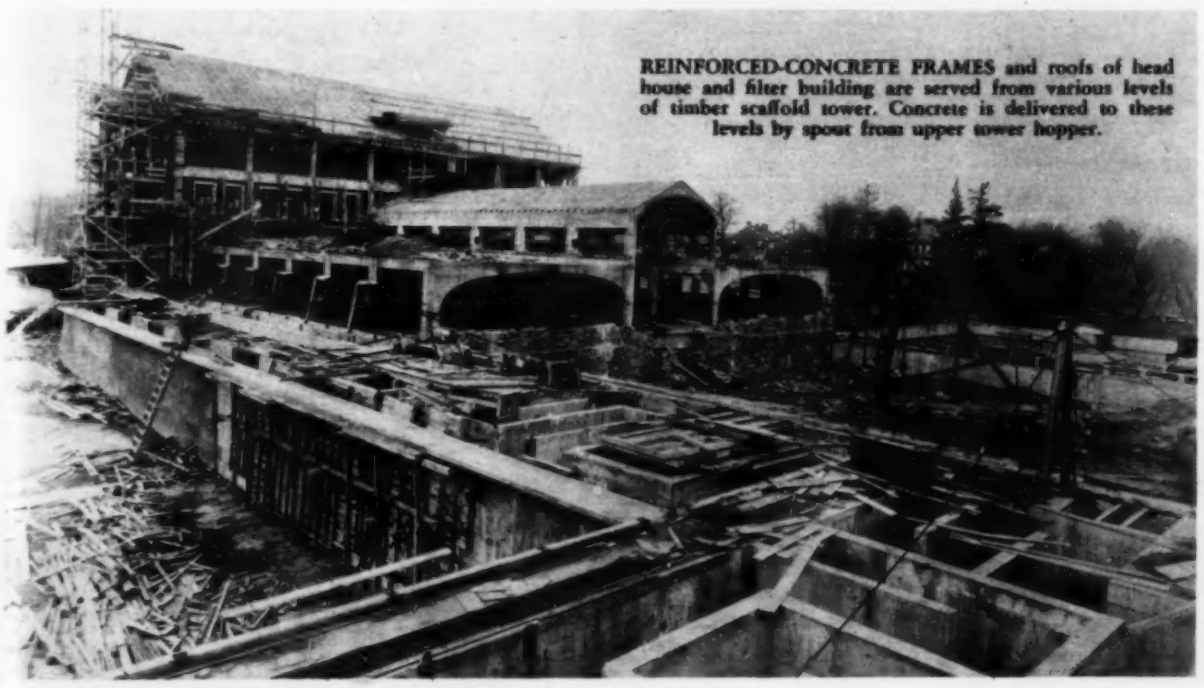
in floors and walls of the settling basins, the tower was equipped with a single hopper which discharged concrete into 1-yd. hopper bodies on end-dump trucks or into hand carts on the scaffold runways. As the concrete work in the head house and filter building moved upward, a second hopper was installed at a higher point on the tower. From this hopper was suspended a vertical chute, with removable sections at each platform level on the timber scaffold adjacent to the tower. By removing a detachable chute section, buggies could be filled at any level with concrete for the corresponding floor of the buildings. The concreting methods are indicated by the accompanying photographs.

Only one change was made in the position of the upper hopper, when it was necessary to raise it to a higher level to pour the roof, a reinforced-concrete slab 6 to 8 in. thick cast monolithically with the supporting structural members on a slope of about 3 on 5 (the roof rises 21 ft. to the ridge in a horizontal distance of 34 ft.). To place this concrete, the contractor erected two runways above the ridge, one on each side of it, to enable the wheelers to dump their carts either over the outside edge or into the center. Dams were provided in the forms to keep the concrete from flowing off the slope.

TRIO OF CONSTRUCTORS *(at right):* **(Left to right) L. E. Wolfe, assistant resident engineer for Bureau of Water; F. P. Edele, office manager, William Steele Sons Co.; and V. Davis, superintendent, Roberts Filter Manufacturing Co., Darby, Pa., contractor for filters and piping.**

THREE SETTLING BASINS *(below)* **completed, with temporary openings in dividing walls closed.**





REINFORCED-CONCRETE FRAMES and roofs of head house and filter building are served from various levels of timber scaffold tower. Concrete is delivered to these levels by spout from upper tower hopper.

Administration — As part of its $2,500,000 program, the filter plant was constructed for the City of Reading by the Bureau of Water, A. R. O'Reilly, chief engineer. All construction operations were under the immediate direction of E. A. Elbert, resident engineer, with L. E. Wolfe, assistant resident engineer, in charge of eight contracts at the filter plant. For William Steele Sons Co., Charles F. Reichert was superintendent and F. P. Edele was office manager. John S. Cole was resident engineer-inspector for the Federal Emergency Administration of Public Works, which aided in financing the project by a grant.

CONTROL *means* LUGG

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(*Above*)
These fast-stepping Model "L-O" Oil Tractors and 7-yard Continental scrapers are grading, leveling and filling on an Illinois highway job. Two of three new units owned by Winnebago County Highway Department.

• •

(*Left*)
"They sure move dirt", says William L. Lathers, Jr. of his 5 Model "L-O" Oil Tractors and 7-yard Continental Scrapers. No time wasted on this job. Big loads and plenty of speed assure big yardage at low cost.

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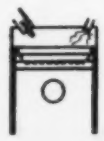

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SEVENTH OF A SERIES OF ARTICLES

Planning and Plant for
HEAVY CONSTRUCTION

Principles and Practices of Job Layout and Selection and Use of Equipment for Large Dams and Appurtenant Works

. . . 7 . . .

Cofferdam Design and Construction, Including Earth Fill, Rock Fill, Continuous Wood Frame and Crib Types

By ADOLPH J. ACKERMAN *and* CHARLES H. LOCHER
Construction Plant Engineer *Construction Consultant*
TENNESSEE-VALLEY AUTHORITY, KNOXVILLE, TENN.

ONE of the biggest opportunities for economy in the construction of a dam rests in developing the best possible scheme for handling the river. The real test of superior judgment in this respect depends upon the most logical consideration given to the following five questions:

(1) *River Regimen*—What are the flood characteristics of the river? This requires a careful analysis of hydrological data extending as far back as possible. Annual hydrographs bring out the occurrence of seasonal flood and low water conditions, as well as the history of unexpected off-season floods. Where suitable discharge records have not been kept, it is frequently necessary to interpolate by an analysis of rainfall data and their characteristics of run-off, or by a study of similar adjacent drainage areas.

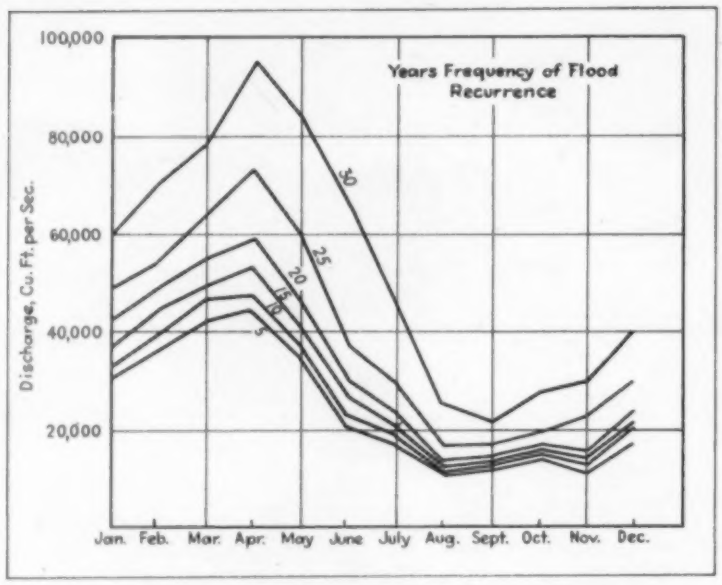


Fig. 2 . . . FLOOD FREQUENCIES plotted for each month of the year define flood risks and indicate necessary cofferdam heights.

(2) *Flood Hazards*—What are the flood hazards and what risk should be assumed by the constructor? It is one thing to gamble on the probability that no flood will occur during the construction period; it is quite another thing to apply sound judgment to the estimating of flood damages and cost of delay to work, and to estimating the point where additional flood protection would cost more than the damage which might occur. In developing this judgment it is necessary to study flood frequencies on charts such as the ones shown in Figs. 1 or 2. By making charts similar to Fig. 1 for a complete series of discharges a clear picture is gained of frequencies with which floods greater than a given magnitude have occurred in the past. In Fig. 2 the data are combined to indicate frequencies for each month and such a chart is valuable in relating cofferdam heights and construction stages for maximum economy to the general pattern of flood frequencies and probabilities throughout the year.

(3) *River Handling Methods*—What is the most economical type of channel for handling the river during construction and for making diversion and final closures? A careful study must be made of the following: Seasonal flow conditions; discharge capacities of the constricted river channel when partly cofferdammed off; hazards and difficulties of diverting the river from its natural bed into a new diversion channel or into diversion tubes; and an economical balance between hydraulic capacity of such diversion passageways and their cost of construction, including the necessary appurtenant gates or other elements for making the final closure when the dam is completed. The study of these problems on hydraulic models, as illustrated in Fig. 8, is justified in practically every case and generally will point out important economies

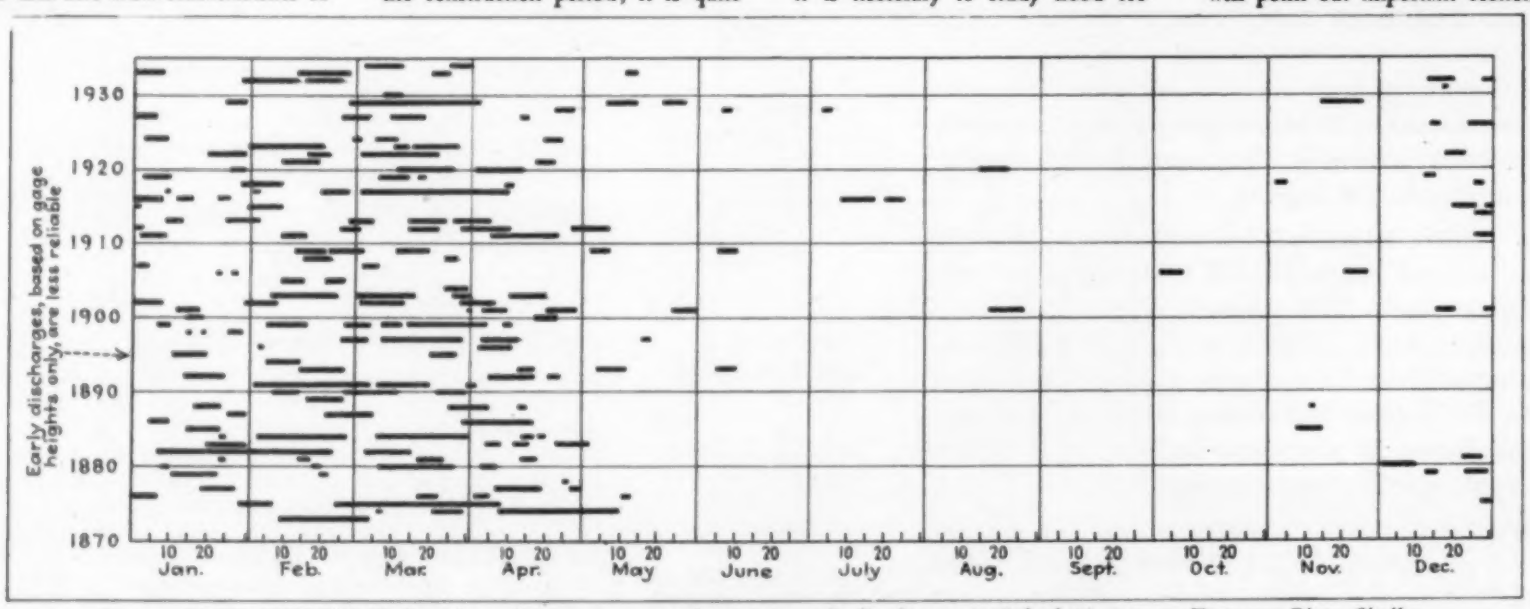


Fig. 1 . . . RIVER DISCHARGE charted to show occurrences of 150,000 sec.-ft. floods over period of 64 years on Tennessee River. Similar charts for higher floods help to define flood risks and cofferdam heights.

in design or construction which will save the cost of such a model many times over. In any case, the model will confirm the soundness of the proposed river handling methods and in this respect is equivalent to an insurance policy against otherwise unforeseen construction risks and hazards.

(4) *Cofferdam Type and Height*—What is the most economical type and height of cofferdam? This involves a thorough analysis of available materials, foundation conditions,

Fig. 3 . . . FLOOD GATES OPENED to fill Gallipolis cofferdam on Ohio River in West Virginia in anticipation of high flood.

year, and the water will be permitted to rise 10 to 15 ft. over the top of the cofferdam.

On other jobs it is necessary to provide only for the probability of flooding if seasonal conditions should turn out to be unfavorable. However, there again the proper design of the cofferdam to withstand overtopping is an important factor. In such cases it is common to provide gates or other means for filling the cofferdam area at a moderate rate, as shown in Fig. 3, before the

Fig. 4 . . . FIRST STAGE of construction is beginning at Madden dam. Excavation is in progress, with levee left in place to serve as cofferdam. Single wall piling is being driven through levee to cut off seepage.

Fig. 5 . . . FIRST STAGE of Madden dam completed. Diversion channel (center) is formed partly by section of dam and retaining wall, with timber cribs and steel cells, connecting with cofferdam in course of construction across river at upstream and downstream ends.

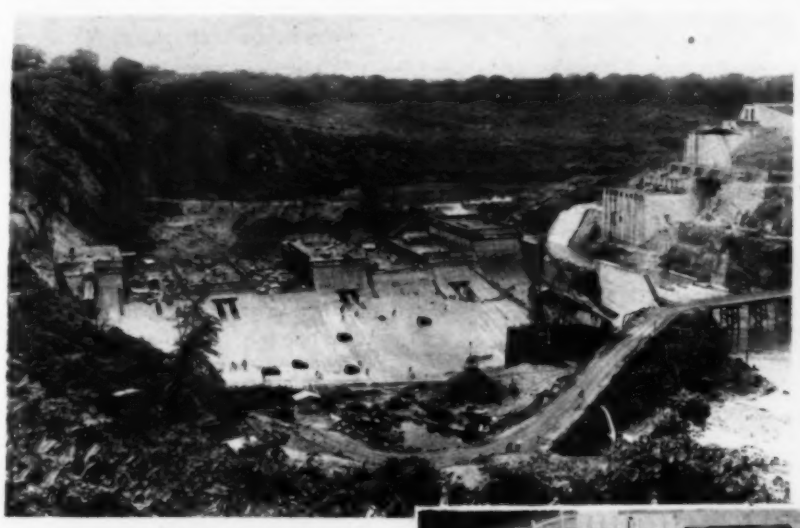


Fig. 6 . . . SECOND STAGE of construction at Madden dam. Flow of river has been turned into diversion channel and building of main dam is in progress.

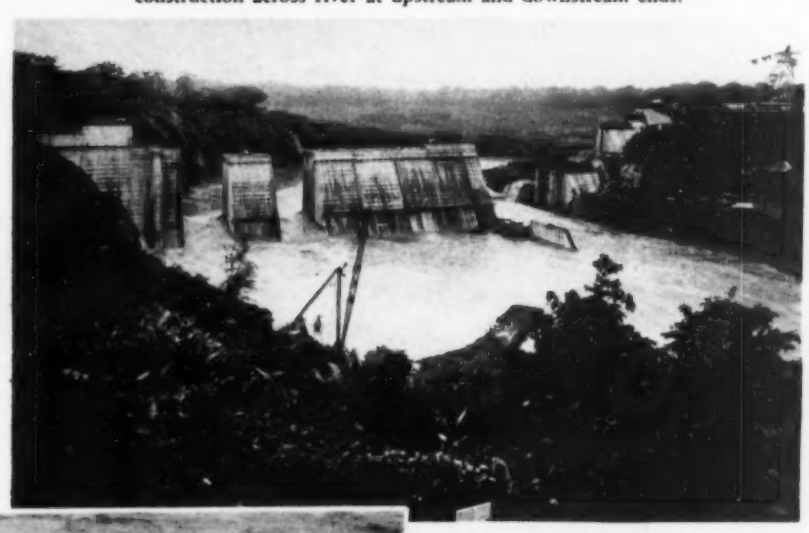


Fig. 7 . . . FLOODS reach the site of the partially completed Madden dam. Two sections of dam left open to supplement capacity of diversion channel to carry stream flow.

tendency to scour either around or under cofferdams, methods of waterproofing, and probable leakage and pumping requirements within the cofferdam. In the majority of cases it is not economical to build a cofferdam to such height that protection is provided against the most severe floods. At Bonneville dam, on the Columbia River, it was found necessary to limit the height of cofferdam to a point where the flood season will cause suspension of the work for more than a month during each

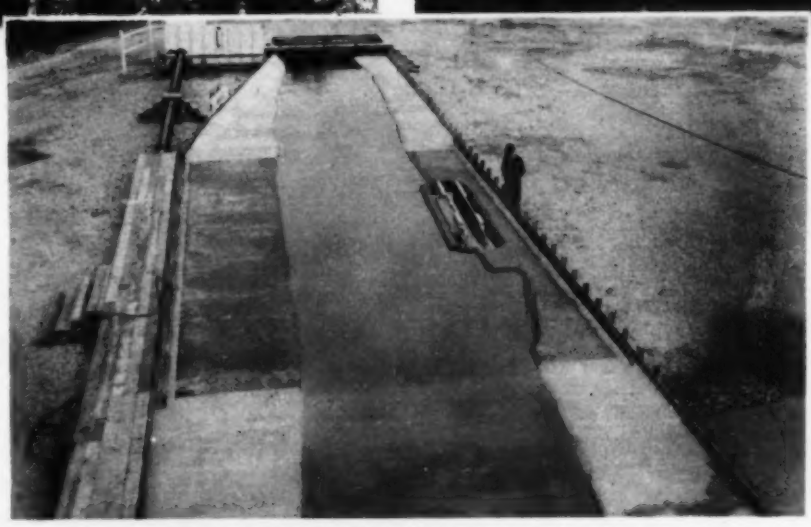


Fig. 8 . . . HYDRAULIC MODEL of Pickwick Landing dam site for studying cofferdam layouts.

crest of the flood arrives, to prevent damage which might otherwise occur from water falling into the area from all sides. An important relationship to keep in mind in the design of cofferdams is that greater capacities in the diversion structures, mentioned under the foregoing paragraph No. 3, will often mean lower cofferdam heights and this calls for a careful study of the proper economical balance.

(5) *Construction Sequence*—What is the most economical sequence in

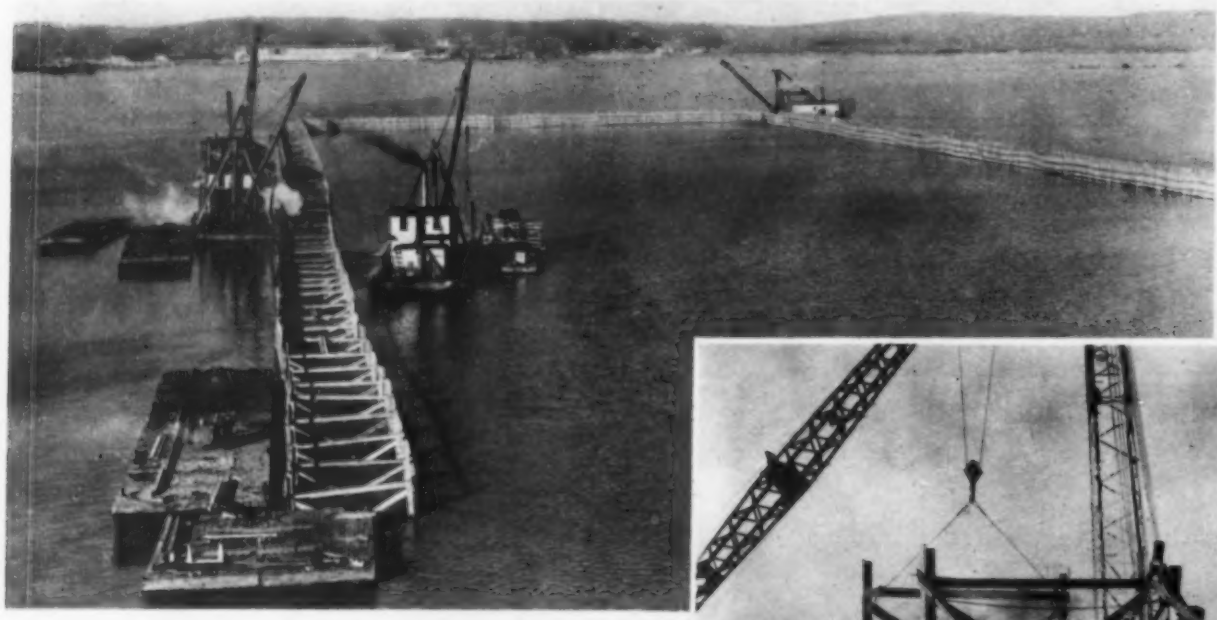
Fig. 10 . . . PLAIN ROCK FILL TYPE of cofferdam built by dumping rock previously excavated from section of construction area.

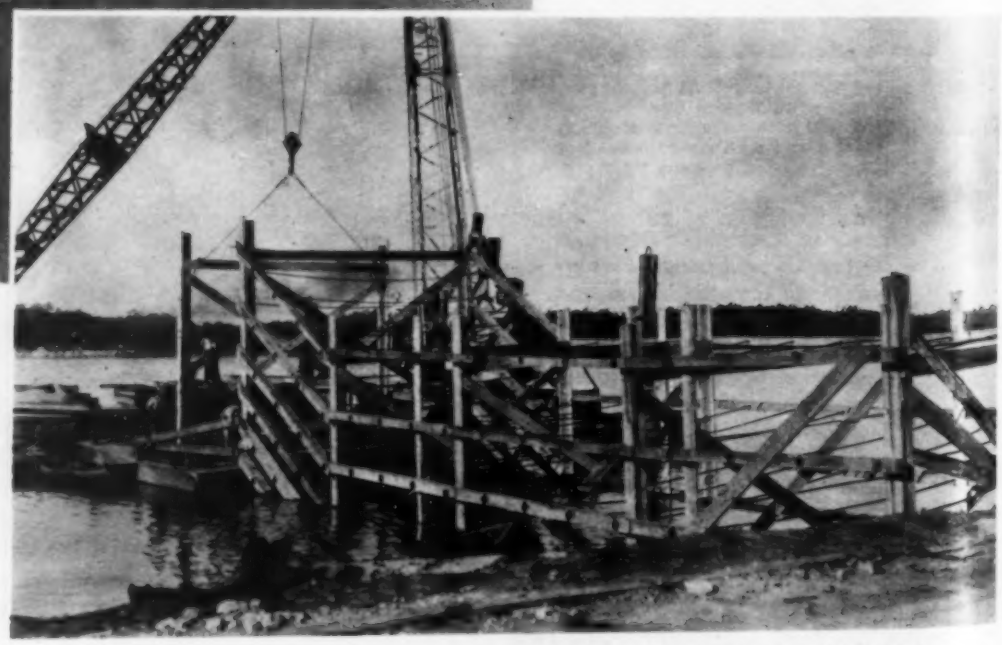
Fig. 11 . . . CLAY MAT forming seal over rock-fill cofferdam, and timber mats to protect clay from wave wash.

Fig. 9 . . . TEMPORARY EARTH-FILL TYPE of cofferdam for preparing foundation of main cofferdam at Boulder dam. White line on canyon wall indicates outline of main earth-fill cofferdam.

building the various stages of the structure? Except in cases where it is possible to divert the river into a tunnel or other channel where it offers no further interference with construction operations, it is necessary to handle the river one or more times and provide suitable space in the partly completed structure for diversion passageways. This usually results in the dam being split up into stages of varying magnitudes. Here, again, money can be made or lost, depending upon the sequence which is laid out for building the various stages, because this directly affects the entire construction plant layout. It is important that diversion procedure and cofferdam heights should be in proper balance with the ability and limitations of the construction plant. Major economies can be developed if the stages are laid out and properly coordinated with the range of operation of the plant, so that in most cases there is always a place to deposit concrete and thus allow the plant to operate continually at a high rate of production. It is not enough to set up a fine plant with a capacity of, say, 3,000 cu. yd. of concrete per day, although this may be the correct capacity, only to find that the diversion program has split up the job to such an extent that concrete can only be deposited at an average rate of 2,000 cu. yd. per day because there are not enough other places available for placement. For a given speed of construction the real economies come from operating a plant at its capacity output as much as possible.

The foregoing may be translated into the following mathematical expression: Plant cost, plus operating cost, plus river handling cost, plus miscellaneous costs should produce the minimum cost of the project. This equation must be correctly solved before the job starts, in order to develop the biggest profits or economies. One of the first decisions to be made on a new job is how much to spend for plant. It is easy enough to see from the equation that a higher plant cost is sometimes justified where this will permit a corresponding reduction in operating cost and river handling cost, and a decrease in attendant uncertainties. It takes sound judgment and courage





Figs. 12 and 13 . . . OHIO RIVER TYPE of cofferdam built at Wheeler dam *(above)* with floating equipment. Derricks in background are dumping earth fill from barges into cofferdam. DETAIL *(right)* shows method of building Ohio River type cofferdam frame.

to spend enough for plant to develop the lowest summation of these costs.

Layout of Construction Stages—Figs. 5, 6, 7, and 8 offer interesting illustrations of an economical layout of construction stages for the Madden dam. This layout was devised by O. N. Floyd and M. H. Slocum, of the contractors' organization. The first stage consisted of developing a cofferdam on the left bank of the river out of the natural earth deposit, with a single-wall sheetpile cut-off, and constructing within this area a diversion channel. This channel, which is shown in Fig. 6, was crowded as far as possible to the left end of the dam, and part of the channel sides were formed by the permanent retaining wall and a low section of the main dam. This wall and section of dam served also as a cofferdam for the second stage. Fig. 7 shows construction under way on the second stage of the dam after the river had been turned into the diversion channel. Here an important principle of plant layout is apparent. The overhead cableway makes the concrete-placing plant independent of river handling methods

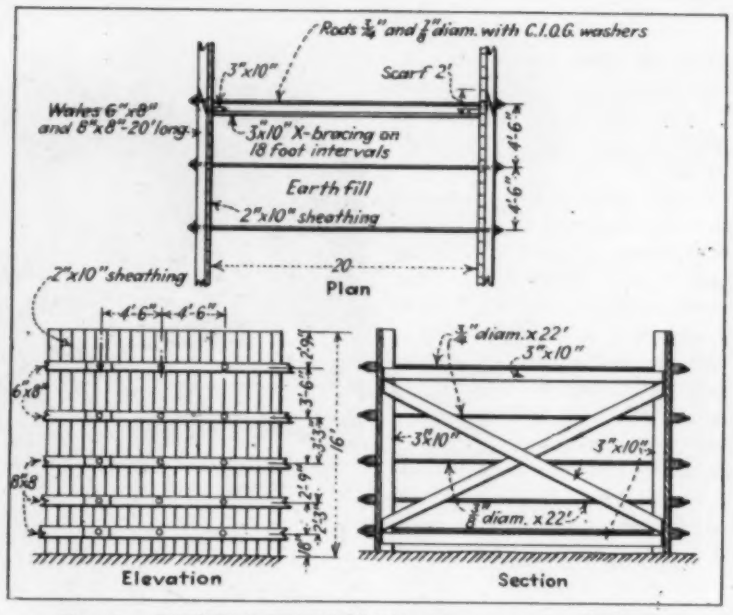


Fig. 14 . . . DESIGN DETAILS of Ohio River type of cofferdam at Wheeler dam.

diversion channel and, true to tradition, a flood of unprecedented magnitude occurred during that season. As soon as the flood season was over, these two blocks were completed, and during the low water season the diversion channel was closed off to permit construction within that area while the river passed through the permanent sluice tubes shown near the base of the dam in Fig. 7. Incidentally, Figs. 7 and 8 give an interesting comparison of river conditions for which the construction planner must make adequate provisions. The method of diverting the river will be described in a succeeding chapter.

Earth-Fill Cofferdams—The simplest type of cofferdam is an earth-fill levee which can be used to advantage where the material has the characteristics of stability, compactness and impervious-

Fig. 15 . . . CRIB COFFERDAM of simple type built with poles from local woods. Note skid rigs and supports for working platform.

Fig. 16 . . . ROCK-FILLED CRIB cofferdam *(left)*, with earth fill on water side for water seal. Note crib wings along river to protect corners of cofferdam.

and these can, therefore, be developed in their most economical manner.

During the first stage a relatively small amount of concrete was placed, at considerably above the average unit cost, largely because of the low production rate and because it was necessary to train the crews and tune up the plant. A general shutdown of the plant after this concrete was in place was used to make adjustments and corrections to improve its operation. After the river had been diverted and the foundation uncovered, the entire remaining portion of the dam was then within reach of the cableways so that concreting could proceed at the best output capacity of the plant at all points on the dam.

Fig. 8 shows the precautions taken with respect to the second flood season. Two of the main blocks in the dam were left low to provide extra channel capacity to supplement the

cofferdam is used to facilitate construction of a more permanent type of cofferdam behind it, as was done in the case of Boulder dam shown in Fig. 9. On some projects an earth-fill cofferdam may be developed by leaving some of the natural deposits in place, as was done at Madden dam, which is shown in Fig. 5. In such cases, it is essential to explore accurately the nature of the deposits and to determine the needs for sheetpiling or some other form of seepage cut-off to stabilize the inner slope and minimize unwatering problems within the area.

Rock-Fill Cofferdams—Next in order of simplicity is the rock-fill type of cofferdam, such as is shown in Figs. 10 and 11. This type of cofferdam merits consideration where a supply of rock is economically available as, for instance, from an excavation area such as a power-house substructure, where disposal to some point or other is required in any case. This occurred in one section of cofferdam at Wheeler dam, where the illustrations were taken.

The rock-fill cofferdam can be constructed in more turbulent water which would wash away the ordinary earth fill. However, the rock fill requires some form of seal and at Wheeler dam this consisted of a layer of clay deposited on the water side, with timber matting at the water line to protect the clay seal against wave wash. The chief precaution necessary with this type of cofferdam lies in determining the feasibility of making an effective seal, because with a poor seal it is, as a rule, difficult to locate the point of leakage and make adequate repairs after the cofferdam has been unwatered. This condition becomes even more serious on a porous foundation where the rock fill itself may be quite impervious but water is passing into the cofferdam through some of the rock fissures. Due to the irregular face of the rock fill and the tendency for large boulders to roll

down and spread over a considerable area of the river bed, it is quite difficult to locate such leaks and to seal them effectively. Such sealing problems may, at times, cause enough delay in unwatering the cofferdam to consume most of the economies which may have been obtained from the cheaper initial construction.

Ohio River-Type Cofferdam—Figs. 12 and 13, show a cofferdam generally used on the Ohio River for relatively shallow water, and where the velocities are sufficiently low to permit this type of construction. Design details are shown in Fig. 14. This type of cofferdam is particularly economical for a height of 15 to 20 ft. because of its simplicity and the speed with which it may be constructed. The operations consist of assembling the frame members with suitable tierods on a barge and making a continuous chain of these frames which are lowered into the water successively as the framing proceeds. After the frame is in place vertical sheeting is installed and the cofferdam is then ready for filling with clay or other impervious earth which provides adequate stability and a tight seal at the bottom. The important feature of this type is the need for low velocities in the river during construction to avoid overturning the timber structure before it is filled with earth. This type of cofferdam can withstand only a small amount of overtopping.

Rock-Filled Crib Cofferdams — For working in swifter water, and where greater height and the possibility of overtopping must be provided for, rock-filled cribs have found most popular application. Wherever possible it is desirable, first, to level off the bottom of the cofferdam site; otherwise, it is essential that the base of the crib be built so as to fit accurately any irregularities of the river bottom. It is common practice in the design of such cribs against sliding and overturning to make the width equal to the head of water which they must support. Other factors to be taken into account include internal shear, bursting pressure from within due to the fill material, and moment and shear in the walls themselves.

Such cribs can be of very economical design and construction as for example the ones shown in Fig. 15, which are built up of poles obtained from clearing in the reservoir area. The customary procedure is to build the base of the crib on land or out on the dry and to shape the bottom to fit the rock contours which have been previously determined from soundings. This frame is then floated into its approximate position and additional timbers are built up on top until the bottom finally comes to rest on the rock. At this point a certain amount of rock may be dumped into the crib to help stabilize it, or the construction of the crib framing may continue to its ultimate height if there is no tendency for it to move away.

Watertightness may be developed either as shown in Fig. 16 by dumping an earth fill against the water side, where there is no tendency to scour, or by lining a chamber of the crib with vertical sheathing, filling this with earth or clay and the remaining portion with rock. A third method of sealing rock-filled cribs, particularly when exposed to turbulent water, consists of facing the water side with a double layer of surfaced and tight-fitting planking.

The power-house cofferdam at Conowingo dam consisted of a main row of rock-filled cribs which were designed for stability and a second row of cribs on the outside with sufficient space between the two to develop an intermediate chamber which was filled with clay. This type, which is shown in Fig. 17, is especially suited to very rough river bottoms where a wide band of clay is the most effective sealing medium. At the same time the clay chamber is protected from erosion and the design is economical in the use of impervious material where there is a scarcity of it.

Fig. 17... CLAY CHAMBER between double row of rock-fill cribs at Conowingo dam.

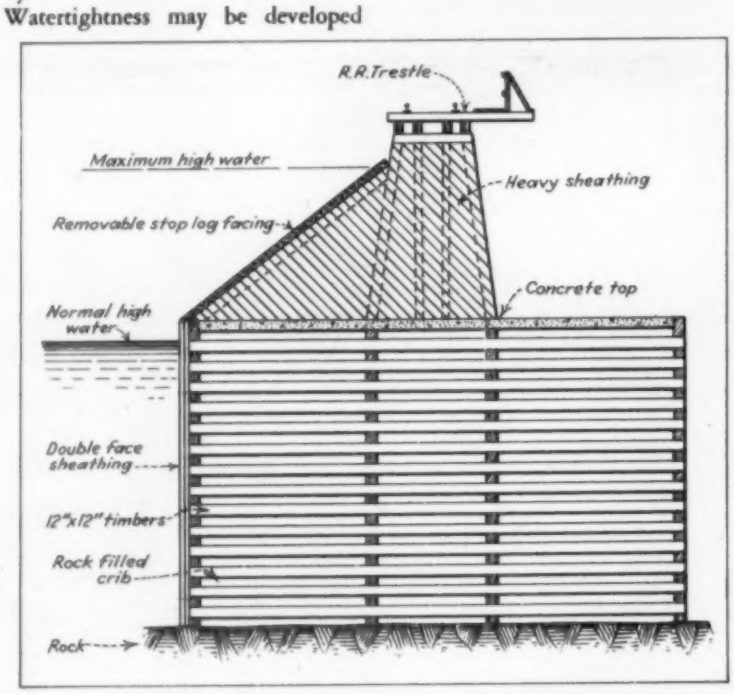


Fig. 18... CRIB COFFERDAM designed with special provisions for overtopping at Chute-a-Caron dam.

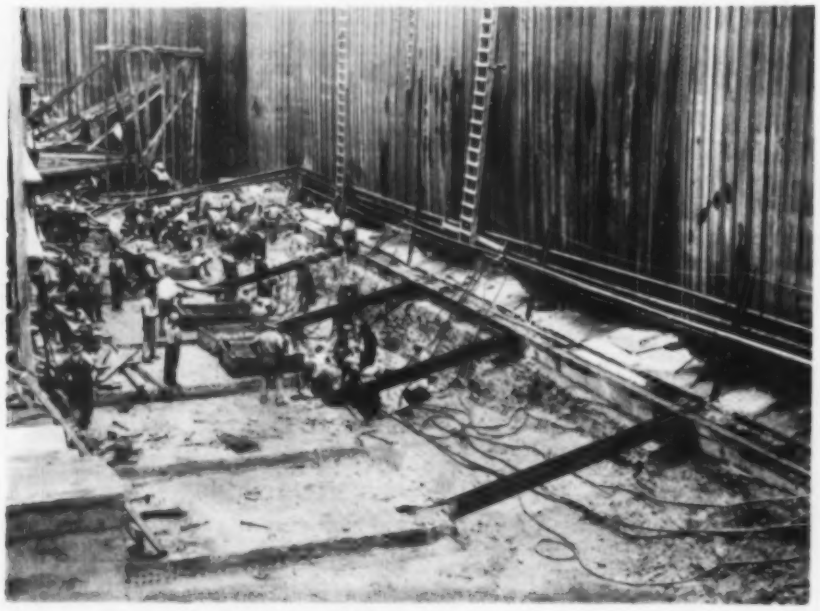


Fig. 19... SPECIAL SUPPORTS for base of cellular cofferdam to resist sliding while cutoff trench for dam is being excavated below base of cofferdam.

A very economical type of rock-filled cofferdam was employed on the Chute-a-Caron dam, in Canada. The problem in this case consisted of designing a crib which at times would be overtopped with a very heavy discharge, without letting the water rise above a given maximum level. Fig. 18 shows the general features of the design which was originated by C. P. Dunn. When the removable stop logs are in service, the weight of water on them is utilized in helping to stabilize the crib. The stop logs rest against the trestle bents. These are covered with heavy sheathing to prevent the water from attacking the framing of the bents when it is spilling over the top.

Another interesting type of rock-filled crib can be built at a very high rate of speed with the aid of a locomotive crane. This type was used at Conowingo dam and consisted of rock-filled cribs spaced about 10 ft. apart in order to gain distance in a minimum of time and also to avoid building up the head of water unnecessarily. With setting of these cribs going ahead, the next operation consisted of placing stop logs to span from crib to crib. Finally an earth fill was dumped against the outside to develop an effective seal. This same general principle was employed on the cofferdam which ran parallel to the direction of stream flow, and was exposed to scouring action, by making a double row of staggered cribs and connecting each row of cribs with stop logs on the inside and filling the resulting clay chamber with an impervious material for a seal.

❖

NEXT MONTH — Chapter 8 of the series on "Heavy Construction," by A. J. Ackerman and Charles H. Locher, to appear in the July issue, will continue the discussion of "Cofferdam Design and Construction," covering rock-filled crib, concrete wall, steel sheetpile and cellular steel types.

F. L. SHACKELFORD, treasurer of Potter & Shackelford, Inc., building contractors of Greenville, S. C., is the new chairman of the Building Division of the Associated General Contractors of America.

O. W. SWENSON, president of Foley Bros., Inc., contractors, New York City, has been elected chairman of the Heavy Construction and Railroad Contractors' Division of the Associated General Contractors of America. Mr. Swenson's association with Foley Bros. dates from 1888, and his activities have been largely in the field of railroad construction, both in the United States and Canada.

H. B. ZACHRY, road-building contractor of Laredo, Tex., is serving this year as chairman of the Highway Division of the Associated General Contractors of America.

Present and Accounted For

A PAGE OF

Personalities

H. S. FAIRBANK, chief, Division of Information, U. S. Bureau of Public Roads, Washington, D. C., has been assigned by Thomas H. MacDonald to direct a series of state-wide highway planning surveys in 38 states.

GEORGE J. LAWRENCE *(below)*, chief of the construction division, Business Census Branch, Bureau of the Census, is directing a nation-wide census of the construction industry covering 1935 operations. Information, instead of being procured by mail, is being obtained by trained field men of the Bureau of the Census who are making personal calls upon contracting establishments.

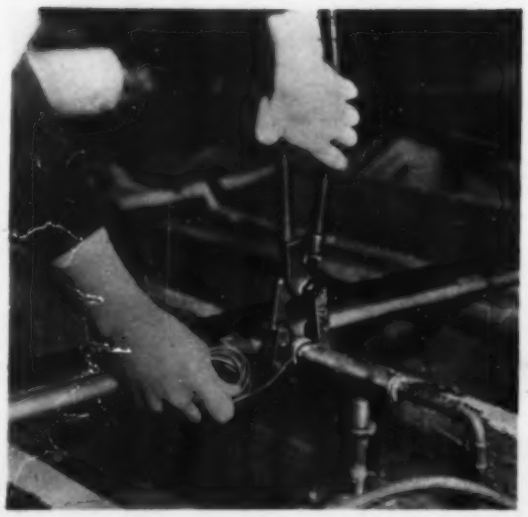
ARIZONA'S HIGHWAY STAFF. Engineer members of department directed by T. S. O'Connell, state highway engineer, are: *(Left to right, standing)*, S. A. Erickson, former bridge engineer and now engineer of State Certification Board; F. N. Grant, district engineer, R. C. Perkins, district engineer, W. R. Hutchins, district engineer, H. C. Hatcher, statistical engineer, J. W. Powers, engineer of materials. *(Bottom Row)* J. S. Mills, estimating engineer, Percy Jones, chief location engineer, R. A. Hoffman, bridge engineer; George Shaffer, district engineer.

PORTABLE ARC-WELDER *(below)* of 150-amp. capacity designed to cover broad range of welding jobs, develops high electrical efficiency with small air-cooled gasoline engine. Uses bare or coated electrodes from 3/32 to 3/16 in. for welding materials of varying thicknesses. Welding is simplified through single current control accomplished by shifting brush holders for current settings over entire welding range. For field service standard unit can be mounted on two-wheel highway trailer of all-welded construction with engine and generator protected from road shocks by automotive type cantilever springs and balloon tires. Also available mounted on four-wheel industrial truck or for factory use with skid mounting. —Harnischfeger Corp., Milwaukee, Wis.

NEW EQUIPMENT

On the Job

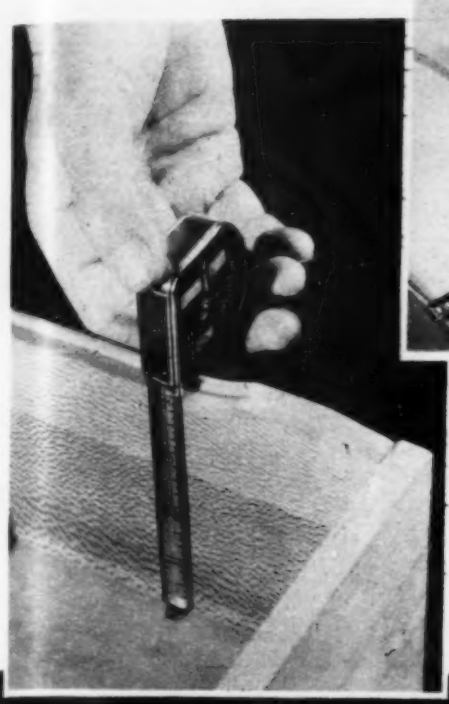
PNEUMATIC-TIRED DRILL RIG *(two photographs above)* with continuous pneumatic-feed is built to drill holes at any angle. Following features: (1) Built-in jack enables operator to set U-bar to any position; (2) main wheels swivel 90 deg. for line drilling or 180 deg. to obtain narrower tread, easily locking in all positions; (3) standard road-gage can be made 16 in. narrower by use of swivel-wheel feature; (4) tubular frame, utilized as receiver, acts as pulsation compensator, resulting in more uniform piston reciprocation; (5) loosening of two nuts permits drill to be swung to any angle; (6) forward leg point holds steel in line when drilling angle and flat holes; (7) automatic feed can be regulated to exactly the right feeding speed and bit pressure for fastest drilling under all conditions; (8) U-bar permits large variety of set-ups not otherwise possible. Length of rig, 7 ft. Nominal steel change, 6 ft. Greatest width, 4 ft. 10½ in. Height when drilling down holes, 9 ft. 7 in. Can be operated in 5-ft. trench.—Cleveland Rock Drill Co., Cleveland, Ohio.

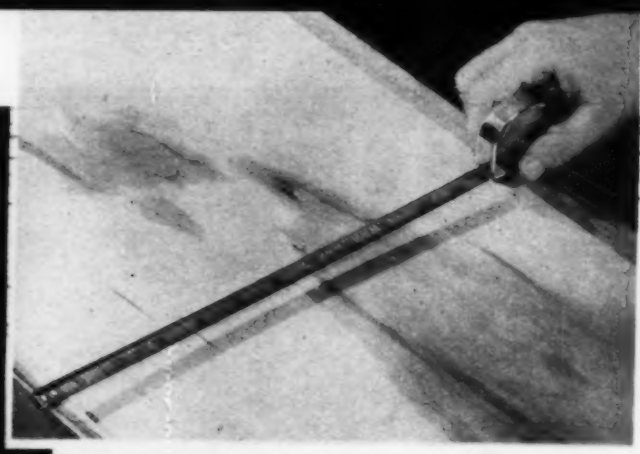


HYDRAULIC CONTROL HOSE, for use on dump trucks, snow plows, graders and other portable equipment, consists of specially compounded oil-resisting rubber tube, one, two or three plies of braided wire, a layer of braided cotton and rubber cover. In sizes ¾-in or larger, layer of cotton duck is embedded in rubber tube to prevent development of pin-hole leaks. All braids of wire and cotton are inserted in rubber. Designed to elongate slightly under pressure, thus preventing hose pulling out of couplings. Method of braiding enables hose to bend easily under pressure and to remain pliable under normal working pressure. Wire braid allows flexibility but does not permit rotation or torsion. Available in sizes from ⅜- to 1¼-in. May be used with any standard, detachable coupling.—B. F. Goodrich Co., Akron, Ohio.

ALUMINUM ALLOY WHEELBARROW *(below)* weighs only 33 lb. for 2½-cu. ft. size and 36 lb. for 4½-cu. ft. size. Dead weight reduction of 40 lb., and 15-per cent increase in pay load is claimed by using Hyb-lum, high-strength nickel-aluminum alloy, for pan and frame. Barrow rides on Goodyear 4x14-in. pneumatic tires, eliminating need for planking or other temporary runways. — Sheet Aluminum Corp., Jackson, Mich.

ELECTRIC HEATING PLIERS *(left)* perform dual function of holding work and supplying heat for soldering in making all soldering connections in electrical maintenance and production and in plumbing and refrigeration jobs. Unit converts standard 110-v. alternating current to low voltage, high amperage current in jaws of pliers. Carbon blocks in ends of jaws carry current to sides of fitting to be heated. At two points of contact on opposite sides of fitting between carbon and metal, heat begins to flow into fitting rapidly and evenly. Two-position jaw openings for gripping large and small work. Especially adapted for applying or removing solder lugs and for making sweated joints in new type copper pipe, tubes and fittings. —Ideal Commutator Dresser Co., Sycamore, Ill.

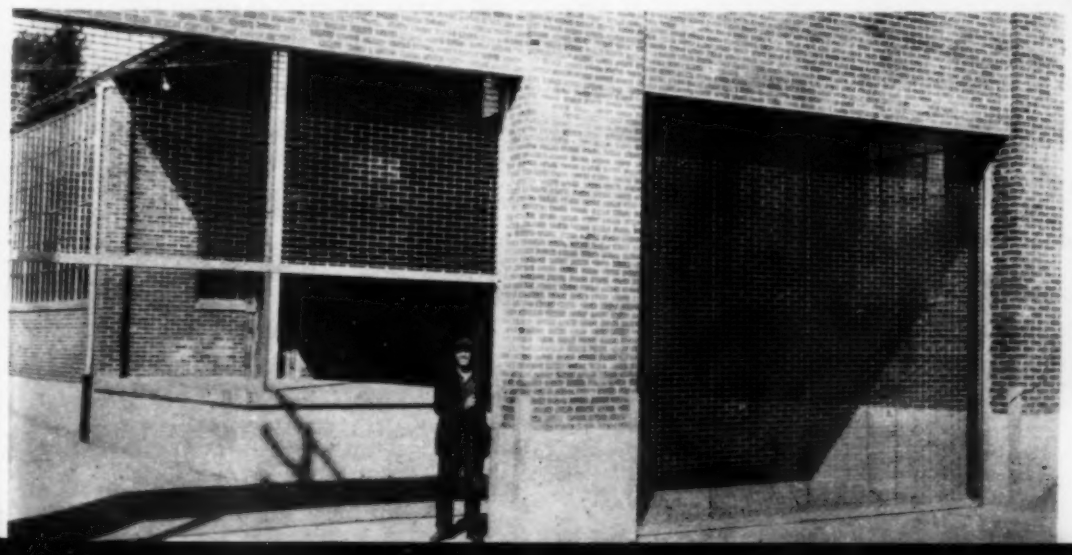




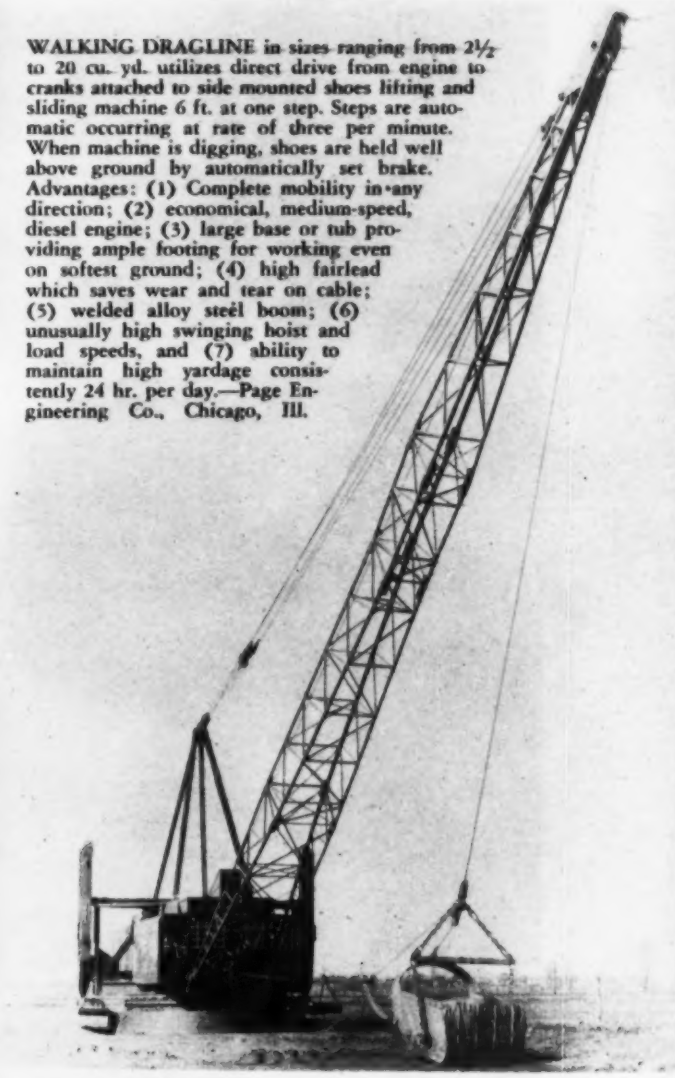
6-FT. TAPE RULE *(left and above)* for all purposes is made of concave steel and can not only be projected, unsupported, in any direction but will also flex to measure circles and unusual shapes. Blade is manually withdrawn and returned to case. Common measuring, either butt end or hook, done in usual way. To take inside measurement, butt square back edge of case against one side of opening being measured, extend blade to other limit and add 2 in. (width of case) to reading clearly indicated at square opening of case. End hook of tape rule has short sliding action and automatically adjusts itself to give accurate results when hooked over any object or projected against any surface. Weight 3 oz. May be carried in pocket.—Lufkin Rule Co., Saginaw, Mich.

FIVE MERCURY-INCANDESCENT FLOODLIGHTS *(above)* have been installed at gasoline station in Schenectady, N. Y. One 400-watt mercury lamp is mounted between two 150-watt incandescent lamps in each unit *(right)*. Because of the blending of blue-green light of mercury and yellow-white light of incandescent, unit gives pleasing quality and quantity of light not obtainable with incandescent alone. Mercury lamp gives twice as much light for energy consumed as do incandescents.—General Electric Co., Schenectady, N. Y.

GALVANIZED STEEL ROLLING GRILLES *(below)* recently installed at factory of Kingston Products Co., in Kokomo, Ind. Made of 5/16-in. hard-drawn galvanized round steel bars connected by malleable iron links, separated by cadmium plated steel tubes. Grilles are attached to overhead pipe shafts which contain tempered springs to counterbalance their weight. They raise by coiling round shaft. One grille is operated by chain; other by electric motor. Power drive is easily installed, only mechanical connection being reducing gears from motor to pipe shaft. Grilles lock into channel-shaped side guides at jambs and will resist pressure of more than 3 tons per foot of height.—Cornell Iron Works, 3600 13th St., Long Island City, N. Y.



WALKING DRAGLINE in sizes ranging from 2½ to 20 cu. yd. utilizes direct drive from engine to cranks attached to side mounted shoes lifting and sliding machine 6 ft. at one step. Steps are automatic occurring at rate of three per minute. When machine is digging, shoes are held well above ground by automatically set brake. Advantages: (1) Complete mobility in any direction; (2) economical, medium-speed, diesel engine; (3) large base or tub providing ample footing for working even on softest ground; (4) high fairlead which saves wear and tear on cable; (5) welded alloy steel boom; (6) unusually high swinging hoist and load speeds, and (7) ability to maintain high yardage consistently 24 hr. per day.—Page Engineering Co., Chicago, Ill.



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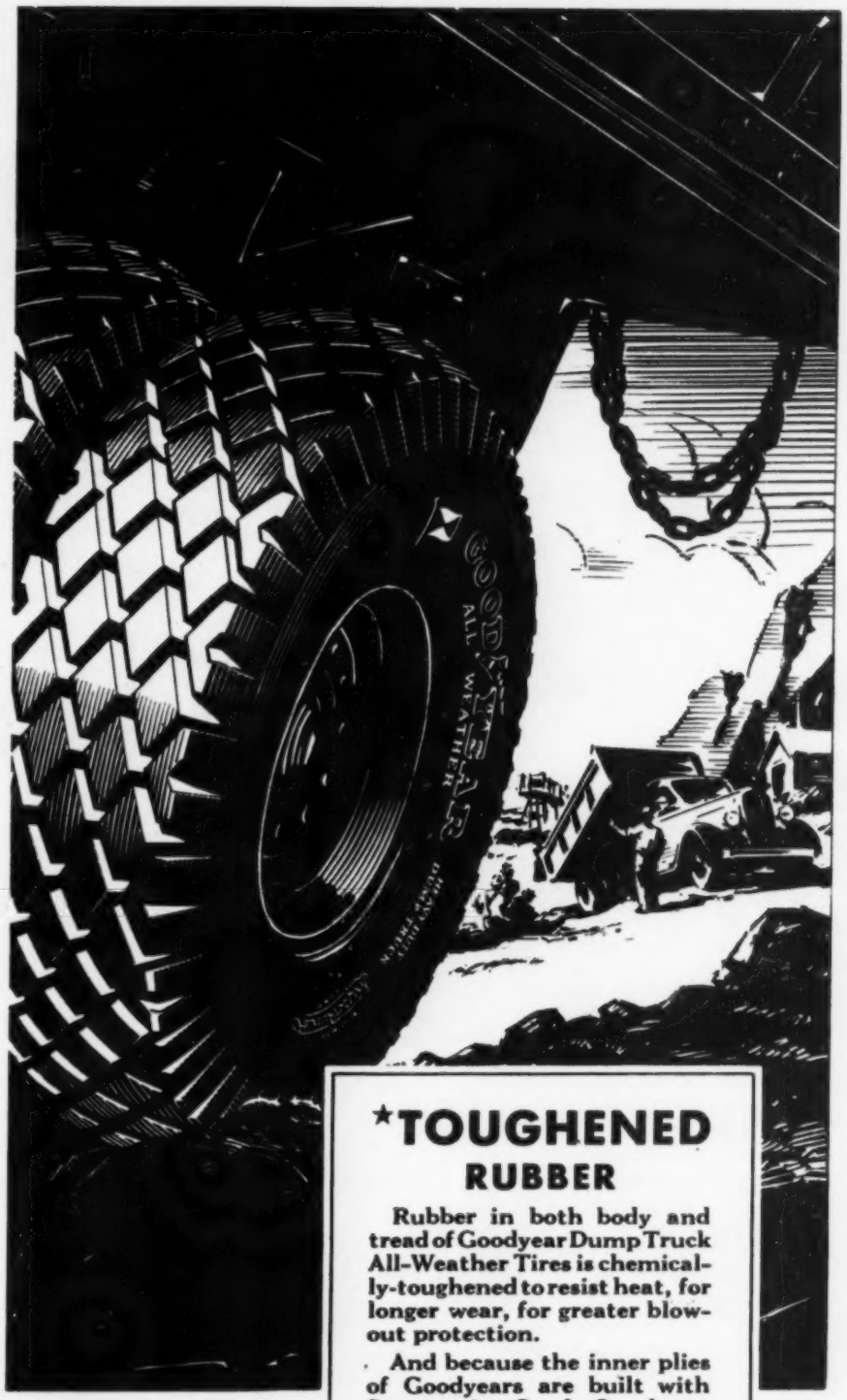

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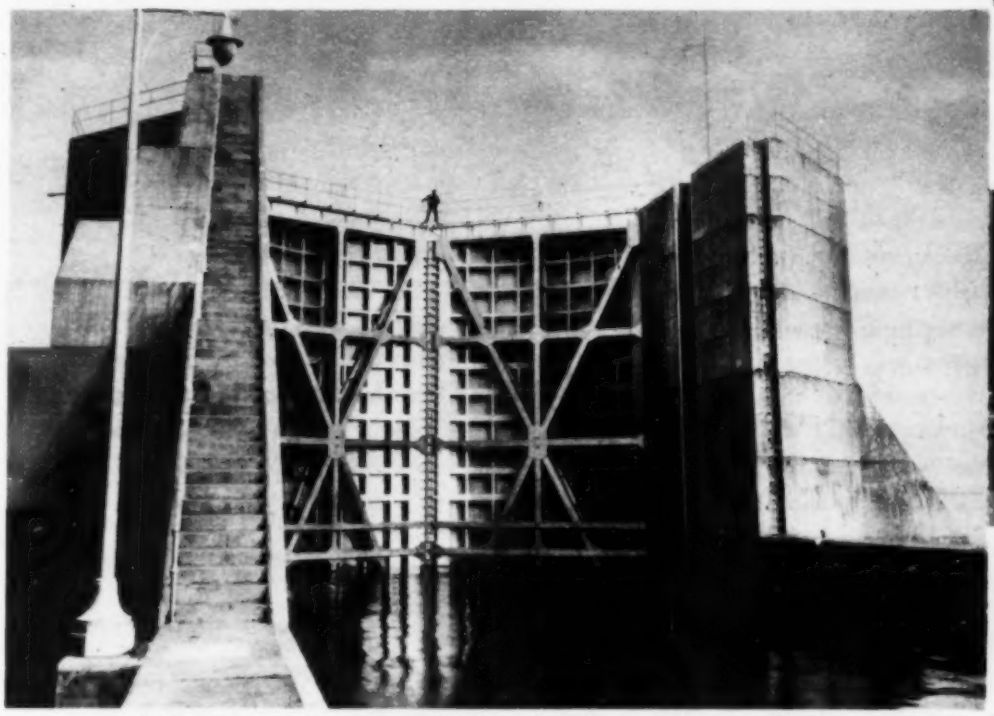
Profit Pointers
for Engineers and Contractors

A Single Reliable Source Meets All Your Steel Requirements

You will profit by buying all the steel construction products you use from Jones & Laughlin. They are available in a wide variety to meet your every need. They are manufactured of selected steel and rigidly inspected and tested to meet not only standard specifications, but also the strict metallurgical specifications set up by the J & L technical staff. Construction time will be shortened and costs reduced when you use J & L construction products, because of their uniform high quality and their close conformity to specifications.

Engineers and contractors everywhere have long profited by specifying and using J & L construction products. You, too, will profit when you look to J & L for all your steel requirements.



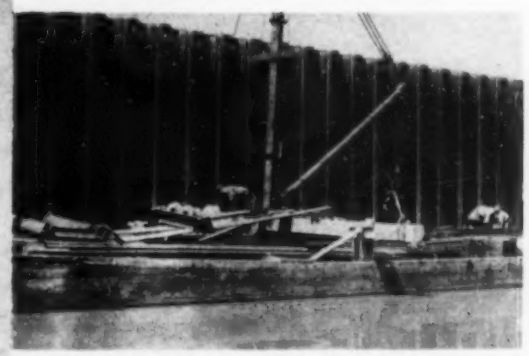
Lock and Lower Lock Gates at Dam No.3 T. V. A. Project on the Tennessee River. These gates were manufactured by Treadwell Construction Company of Jones & Laughlin hot rolled steel plates. These gates are larger than the ones in the Panama Canal locks.

J&L Diamond Bars for Concrete Reinforcement

Construction view of 4 Mile Run Trunk Relief Sewer, Pittsburgh, Pa. J & L Steel Reinforcement Bars, used exclusively here, are rolled of new billet steel. They are uniform in cross section, with clean cut accurate ribs, and they have unusual bending qualities.

J & L Fabricated Structural Work Assures Economical Erection

All fabricated structural steel used in the construction of the Chevrolet Assembly Plant at Baltimore—the largest of its kind in the country—was furnished by Jones & Laughlin. "Fabricated by J & L" means uniform high quality and economical erection.



J & L Steel Piling Gives Economy and Long Life

J & L Steel Piling bulkheads, such as this one recently constructed at Memphis, Tenn., offer an economical solution to shore protection problems. J & L Steel Piling offers important advantages in all types of steel piling work. Its straightness and proper interlock clearance assure trouble-free performance.

J & L Nails and Spikes For Every Construction Requirement

J & L nails and spikes are made of carefully selected wire. They are accurate as to length and gauge, with clean surface, uniform heads and well-cut points.

LOOK TO J&L FOR ALL YOUR STEEL REQUIREMENTS

Piling — Plates — Structural Shapes including Junior Beams and Lightweight Channels — Bars for Concrete Reinforcement

J&L STEEL

Assembled Road Bar Mats — Tie Wire — Steel Pipe — Fabricated Structural Work including Steel Plate Construction — Nails and Spikes

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS

JONES & LAUGHLIN BUILDING, PITTSBURGH, PENNSYLVANIA

Sales Offices: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Erie, Houston, Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Seattle, St. Louis, San Francisco, Tulsa

Warehouses: CHICAGO, CINCINNATI, DETROIT, MEMPHIS, NEW ORLEANS, NEW YORK (Long Island City)*, PITTSBURGH

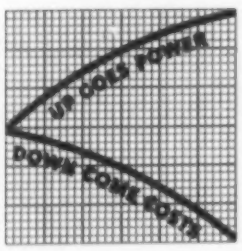
* Operated by National Bridge Works Division of Jones & Laughlin Steel Service, Inc.

Canadian Representative: JONES & LAUGHLIN STEEL PRODUCTS COMPANY, Pittsburgh, Pa., U. S. A., and Toronto, Ont., Canada

Never before have trucks of lowest price offered

CONTRACTORS and BUILDERS

such great pulling power and economy



Contractors and builders engaged in all kinds of construction work are replacing costlier truck equipment with *powerful, low-priced* Chevrolet trucks!

New Chevrolet trucks, with the *greatest pulling power* of any trucks in the entire low-price range, have ample power for the heavier hauls, *plus* plenty of reserve power for emergency loads.

Lower investment and more flexible, faster service are only a part of Chevrolet truck economies. Chevrolet's High-Compression Valve-in-Head Engine has an unmatched record for big gasoline mileage and low oil consumption. New Perfected Hydraulic Brakes, a massive Full-Floating Rear Axle and rugged 4-Speed Transmission are all designed and built to give dependable, economical service—with *lowest* maintenance costs.

Inspect these new Chevrolet trucks! Ask your Chevrolet dealer for a trial demonstration on your own haulage jobs.

CHEVROLET MOTOR COMPANY, DETROIT, MICHIGAN

CHEVROLET TRUCKS

CHEVROLET TRUCKS
prove stamina and record-breaking economy in amazing coast-to-coast run

Look at this great record

Location of Test	Los Angeles to New York
Distance Traveled	3511.5 miles
Running Time	129 hours, 24 minutes
Average Speed	27.14 miles per hour
Gasoline Used	308.6 gallons
Gasoline, miles per gallon	11.378
Oil Consumption	2 quarts
Cost of Fuel	$57.59
Cost of Oil	$.67
Fuel and Oil (cost per mile)	$.016
Average cost per ton mile	$.00328
Water Consumption	1 gallon

No mechanical failures

Entire test conducted under supervision of A.A.A. Contest Board—Sanction No. 3300

CHEVROLET

FOR ECONOMICAL TRANSPORTATION

GENERAL MOTORS INSTALLMENT PLAN—MONTHLY PAYMENTS TO SUIT YOUR PURSE

PIPE
AS YOU LIKE IT

. . . and piping the easy fast and economical way

You'll like ARMCO Spiral Welded Pipe for many reasons; but important among these is its great strength coupled with ease of handling and installation.

You see, there isn't an excess pound of metal in a carload of ARMCO Spiral Welded. You choose the wall thickness that's just right for the job and save metal cost as well as time and labor costs.

This is what you call tailoring pipe to fit the requirements —and you can put it down as certainty that there isn't another pipe on the market that will give you such sturdiness with such easy-handling qualities.

Use ARMCO Spiral Welded Pipe for the jobs suggested at the bottom of this page. You can order it in a wide range of diameters: 6-inch to 36-inch. Wall thicknesses vary from 7/64 inch to ½-inch—the custom-built features mentioned. And remember, ARMCO Spiral Welded Pipe is true round.

Something else: you can use any type of joint with Armco Pipe. Lengths can be as long as you please, up to 40 feet. And you can order regular or special mill-fabricated fittings, ready to be installed with the pipe. This is a great convenience on rush jobs.

If high-flow capacity means anything to you, remember that ARMCO Spiral Welded Pipe offers you this in generous measure. Its inner walls are about as smooth as anything you've ever seen. Then, too, if the pipe you use must be coated, you can get about any kind of coating you want, to meet the condition.

Don't let another pipe job come and go without investigating ARMCO Spiral Welded. There is too much at stake; and by that we mean *extra profits* earned through definite, provable cost-savings, to say nothing of efficiency and durability of the pipe.

Mail your specifications and drawings to the address below—or write for specific information applied to your individual requirements. It needn't be a big job, either; for you can thriftily buy a few lengths or a dozen carloads. What shall it be? The American Rolling Mill Co., Pipe Sales Division, Middletown, Ohio.

Use Armco Spiral Welded Pipe For:

AIR LINES
Pneumatic Tool Supply
Ventilation

WATER LINES
Main and Secondary Supplies, Drains.
Suction headers for well-points and other similar applications.

MIXED CONCRETE

ARMCO SPIRAL WELDED PIPE

BUCYRUS ERIE

STRIPPING FOR
LEHIGH NAVIGATION COAL CO.
SAINT CLAIR COAL CO.
PINE HILL COAL CO.
MADEIRA, HILL AND CO.
BUCK RUN COAL CO.
SUSQUEHANNA COLLIERIES CO.

J. ROBERT BAZLEY, INC.
CONTRACTING AND MECHANICAL ENGINEERS
POWER SHOVEL CONTRACTS
P. O. BOX No. 1, POTTSVILLE, PA.
J. ROBERT BAZLEY
President
Treasurer

November 11th, 1935.

Bucyrus-Erie Co.,
30 Rockefeller Plaza,
New York, N. Y.

Gentlemen:

We are very much pleased with the "AX" dragline buckets that you have recently added to your line. Todate they have given us added capacity without sacrificing strength. They are good digging buckets because they are well designed.

Yours very truly,
J. ROBERT BAZLEY, INC.
J. Robert Bazley
PRESIDENT AND TREAS.

JRB:RE

KEEP RIGHT—BURN ANTHRACITE

"much pleased"

● Mr. Bazley has given further evidence of his satisfaction by repeat orders for twelve Bucyrus-Erie dragline buckets. Profit by Mr. Bazley's example. Take advantage of the extra output and economy of Red Arch dragline buckets.

201

BUCYRUS-ERIE

EXCAVATING, DRILLING, AND MATERIAL-HANDLING EQUIPMENT...SOUTH MILWAUKEE, WISCONSIN

CONTROL ROCK DRILL DUST and PREVENT SILICOSIS

SIMPLE

Equipment is compact and portable. Easy and quickly set up, moved and dismantled. Slip sleeve connections — no pipe fitting necessary.

SAFE

Dust is trapped at the drill hole, the point of origin, and is conducted to dust-tight removable containers.

POSITIVE

Double separation, resulting in gathering of all the drilling-dust, including the invisible, microscopic, disease-producing dust particles.

ECONOMICAL

FAST DRILLING

Proven reduced drilling costs by 25 to 33%.

BECAUSE OF:

Clean drill holes
Reduced drill steel sharpening
Economical to operate
Low first cost.

MARKLEY

DUST CONTROL

EQUIPMENT

"collects and controls"

Silicosis — that insidious lung disease caused by exposure to rock dust — will be no hazard on your rock excavation work if you properly control the drill dust.

The Markley Equipment, developed after years of research and proved on the job, is a simple, portable plant with exclusive features that make control of rock drill dust easy, effective and positive and increases drilling speeds 25 to 33%, thus reducing drilling costs.

Typical units consist of special hoods surrounding the drill steel at the holes, two primary separation tanks, one final separator and a vacuum producer, powered by a gas, electric or air motor—the various parts connected by flexible hose.

Exclusive features include: (1) Quick-detachable hoods that snap on and off the drill steel while drills are in operaton; to attach or detach does not require removal of drill from steel or steel from hole. (2) Dust-tight fiber containers for safe removal of trapped dust from the job. (3) Complete portability of all equipment, permitting out-of-the-way set-ups and easy moving of equipment.

The Markley Equipment is adaptable to all forms of small-bore rock drilling — jack-hammers, wagon drills, universal mountings, drifters and stopers.

phone or write

MARKLEY

DUST CONTROL SYSTEM, Inc.

415 LEXINGTON AVENUE *Telephone: VAnderbilt 3-5675* **NEW YORK, N. Y.**

HIGHWAY OFFICIALS!

THREE WAYS TO BETTER ROADS AND STREETS

BETTER roads are now within the means of every community, every county and every state. Through the use of calcium chloride any dirt or gravel road can be made smooth, dustless and firm. There are three phases of improvement, each requiring a relatively small outlay of money, yet each producing results worth many times its cost.

1 SURFACE DUST TREATMENT, the first step in road improvement: consists of spreading calcium chloride on the road to prevent dust and loss of road materials. Two or three light applications of calcium chloride during the season are usually sufficient to maintain the road in perfectly dustless condition. Even the smallest road budget can afford this method of eliminating the waste, danger, discomfort and contamination caused by dust.

Method 1

Calcium Chloride being applied uniformly on road for dust-proofing.

Method 2

Distributing clay for bonding loosened aggregate or float material. (Has proven highly successful in Michigan maintenance practice)

2 GRAVEL-CLAY TOP-DRESSING, ordinarily a maintenance function in the case of gravel surfaces: consists of adding just sufficient clay to the loose surface material to bind it. The effect is a "skin treatment" which, through the addition of calcium chloride produces a remarkably smooth closed surface, practically eliminating blading except after rains. The operation is reversed by adding aggregate (chiefly sand) when the surface has excessive cohesive material (clay).

3 STABILIZATION, the comparatively new science of using familiar soil materials to build pavement-like road surfaces: Through years of research and tests, soils engineers have established definite formulas whereby soils having characteristic properties—such as cohesion and friction—can be combined in correct proportions to form a stable soil mass. Calcium chloride is added to provide the moisture bond. The resulting surface is smooth, dustless and—amazing as it seems—so hard that it is difficult to dig into even with a pick-axe. A calcium-chloride-stabilized road is truly an all-weather road and, with extremely economical maintenance, can be kept in perfect condition the year-round.

Method 3

A smooth, dustless all-weather road in DeKalb County, Illinois, accomplished by calcium-chloride-stabilization as described.

WRITE FOR LATEST BULLETINS

No. 18—Maintenance of Stabilized Roads, No. 20—Specifications for Stabilized Roads, No. 21—Computing Quantities of Materials for Stabilized Roads, No. 22—Outline of Stabilization, No. 23—Importance of Crown, No. 24—Plant Mixing Calcium-Chloride Stabilized Soils.

The various phases of soil stabilization are thoroughly covered in these bulletins, based on latest findings of research engineers. Additional technical literature is available on all phases of low-cost road improvement with calcium chloride. Write for this information today.

CALCIUM CHLORIDE ASSOCIATION

SOLVAY SALES CORPORATION
40 Rector St., New York City
THE COLUMBIA ALKALI CORPORATION
Barberton, Ohio
THE DOW CHEMICAL COMPANY
Midland, Michigan
MICHIGAN ALKALI COMPANY
60 E. 42nd St., New York City

CALCIUM CHLORIDE
FOR ROAD IMPROVEMENT

Announcing THE NEW Owen Grapple

revolutionary in PRINCIPLE and PERFORMANCE

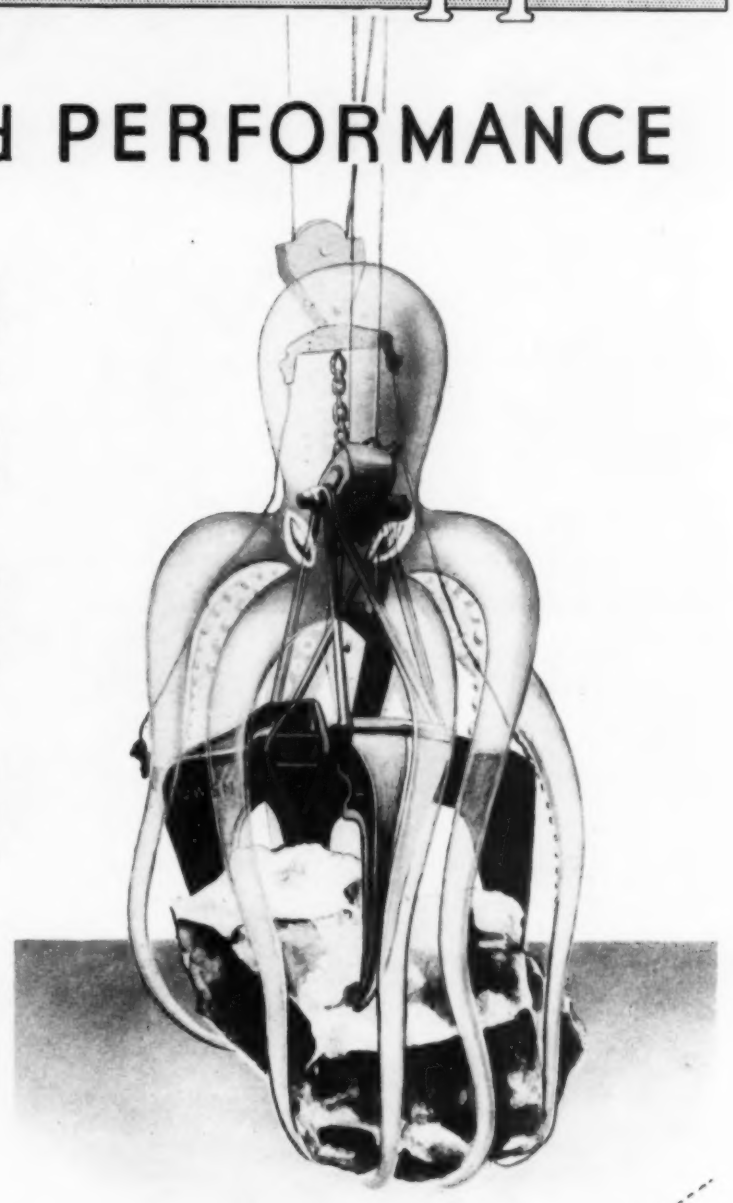
THIS NEW OWEN GRAPPLE has 4 independently operating tines each of which firmly grasps the rock, regardless of its shape.

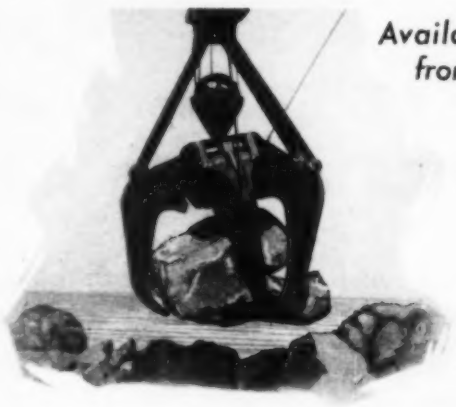
Like an octopus, it *cunningly entwines its victim —exerts super-human strength* and *clings with inescapable tenacity.*

Numbers of these grapples have already proved their exceptional ability in *easier handling, increased capacity* and *greater safety of operation.*

Read our new illustrated, descriptive bulletin and you will clearly understand why this new grapple measures up to Owen standards which demand "a bigger days work."

Mail the coupon for grapple literature or folder describing the advanced line of Owen Buckets which now assure an even larger "MOUTHFUL AT EVERY BITE."





Available in capacities from 3 to 60 tons.

The OWEN BUCKET Co.

• **CLEVELAND** •

New York BRANCHES Chicago
Philadelphia Berkeley, Cal.

Familiarize yourself with the 1936 line of Owen Buckets which includes new models—improved design—added refinements.

MAIL THE COUPON

Send Coupon *for* Literature

Date _____

The OWEN BUCKET CO.
6020 Breakwater Ave., Cleveland, O.

Send me circulars describing the items checked below:

☐ New Rock Grapple ☐ Dredging Buckets
☐ Excavating Buckets ☐ Rehandling Buckets
☐ Coal Handling Buckets ☐ Incinerator Buckets

Name _____

Address _____ City _____

By _____

and an even larger MOUTHFUL AT EVERY BITE *in* Owen Buckets

With its nose in the Air!

INSLEY Type K

3/8 yd FULL REVOLVING EXCAVATOR

An Aristocrat among 3/8 yard Dirt Diggers!

An Enormous Appetite for Dirt . . .

This machine has its nose in the air, but not from conceit, notwithstanding that it has behind it an ancestry of Dirt Diggers of which any machine could well be proud! Its one purpose in its present position is to dump the load high enough to put it where you want it and then to get its nose back in the dirt.

The Insley Type "K" has an *enormous appetite* for dirt.

—and this INSLEY Semi-Trailer hauls TWICE as much DIRT

Think of it — here is a new type of dirt hauling equipment that will haul TWICE as much dirt with the same truck. It's the Insley semi-trailer dirt wagon with a capacity of 5 cubic yards. It will transport far bigger payloads in far less time and at far less cost. This unit is easily adaptable to any truck. Drop-bottom doors are opened by a clutch and closed by a power wind-up — both operated from the cab.

It will be to your advantage to write for complete specifications and prices.

INSLEY MANUFACTURING CORPORATION — INDIANAPOLIS, INDIANA

Specializing in Good Construction Equipment Since 1905

Shovels, Trench Hoes, Cranes, Clamshells, Draglines, Derricks, Wagons, Cars, Buckets, Hoppers, Carts, Concrete Placing Equipment

Roebling...
The pacemaker in
wire rope development
THE most exacting basis for judging wire rope performance is AVERAGE SERVICE.
This is the basis advocated by Roebling, in which rope cost per ton of material handled, or per other unit of service measurement, is based not on the service of a single rope but on the *average* service of several ropes.
John A. Roebling's Sons Co.
Trenton New Jersey
JAR

LOCK #10 - Upper Mississippi Canalization Project

Constructed with BETHLEHEM Steel Sheet PILING

AT many points in the Upper Mississippi river-canalization project, contractors are using Bethlehem Steel Sheet Piling. They have found that the strength, economy and easy-driving qualities of this Bethlehem product make it ideally suited for river canalization work of this type.

The double-wall cofferdam for Lock No. 10 at Guttenberg, Iowa, is a typical example of the way in which Bethlehem Steel Sheet Piling is being used. At Guttenberg, the cofferdam was of the box-type and consisted of two rows of steel sheet piling, tied together with two sets of wales and tie-rods. Approximately 1320 tons of Bethlehem Steel Sheet Piling (AP3) were used in this cofferdam. In addition, 1500 tons of Bethlehem Piling, Section AP8, were installed to form the permanent cut-off walls under the lock structure.

Bethlehem engineers will be glad to submit case histories of the uses to which Bethlehem Steel Sheet Piling has been put in dam, lock and cut-off wall construction and to demonstrate the practicability of its application to any project of this description.

BETHLEHEM STEEL COMPANY, *General Offices:* Bethlehem, Pa. *District Offices:* Albany, Atlanta, Baltimore, Boston, Bridgeport, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Hartford, Honolulu, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, New York, Philadelphia, Pittsburgh, Portland, Ore., Salt Lake City, San Antonio, San Francisco, St. Louis, St. Paul, Seattle, Syracuse, Washington, Wilkes-Barre, York. *Export Distributor:* Bethlehem Steel Export Corporation, New York.

BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL

FIRST CHOICE

for MAXIMUM DAILY YARDAGE

● If you've got to keep dirt MOVING . . . all day long . . . every day . . . put Athey Forged-Trak Bottom Dump Trailers on the job. Then you'll haul consistently, regardless of sticky or hard clay. And you'll haul bigger rounded loads, because Forged-Traks have the capacity and stamina to fit in with modern methods. Used either singly or in train, Athey Forged-Trak Bottom Dump Trailers roll on to profits and greater production. It pays to use them.

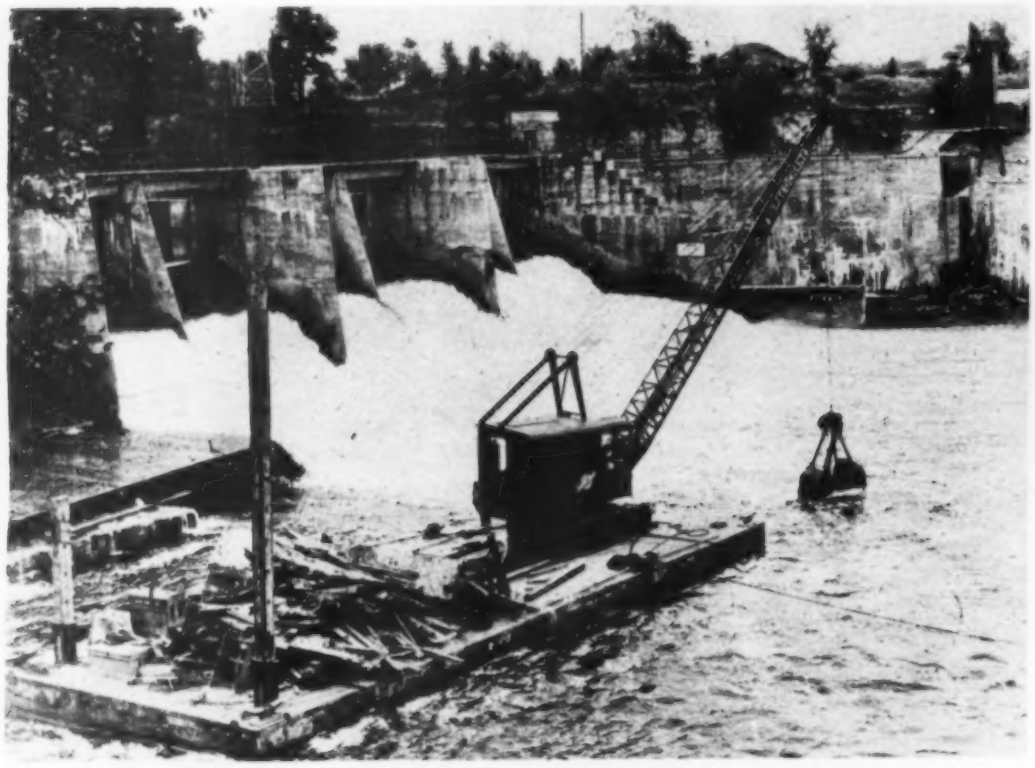
"NOTHING BEATS A FORGED-TRAK!"

ATHEY TRUSS WHEEL CO., CHICAGO, ILLINOIS
5631 W. 65th STREET · DEPT. J · Cable Address, "Trusswheel" Chicago

ATHEY

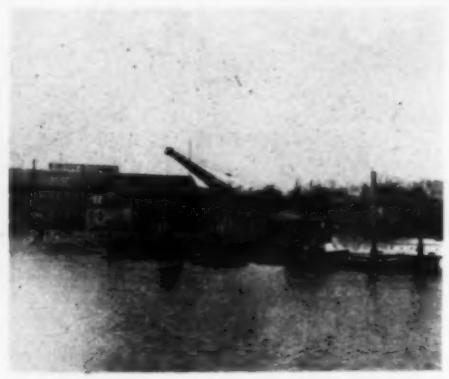
Forged-Trak
REG. TRADE MARK

The SPEEDCRANE and Manitowoc Sectional Scow are the ideal combination for inland waters



The scow is made up of several individual floats which connect together very simply. These units may be shipped by rail, and are handled to and from the water by the crane.

PORTABLE
for ready movement from job to job.



Observe the low boom angle at which this model 1500 SPEEDCRANE operates. A variety of attachments make the combination exceedingly adaptable.

MANITOWOC ENGINEERING WORKS
MANITOWOC, WISCONSIN

"FLEX-PLANE

IN PANAMA CANAL ZONE"

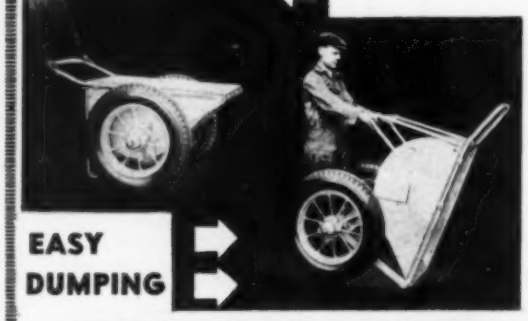
The above photograph shows a Finishing Machine made by the Flexible Road Joint Machine Company of Warren, Ohio.

The natives of the Canal Zone through the guidance of United States Engineers are quite competent in building a "classy" road across the Isthmus — as noted by the perfectly finished surface. Asphaltic ribbon contraction joints were installed — both longitudinally and transversely. The finisher screed is 20" wide — equipped for screeding both forward and backward, and the machine is adjustable for building roads 16 to 24 feet wide.

FLEXIBLE ROAD JOINT MACHINE CO.
WARREN, OHIO.

New CMC "DUMPOVER" PNEUMATIC TIRED CART

EASY WHEELING



Standard size balloon tires — obtainable anywhere.

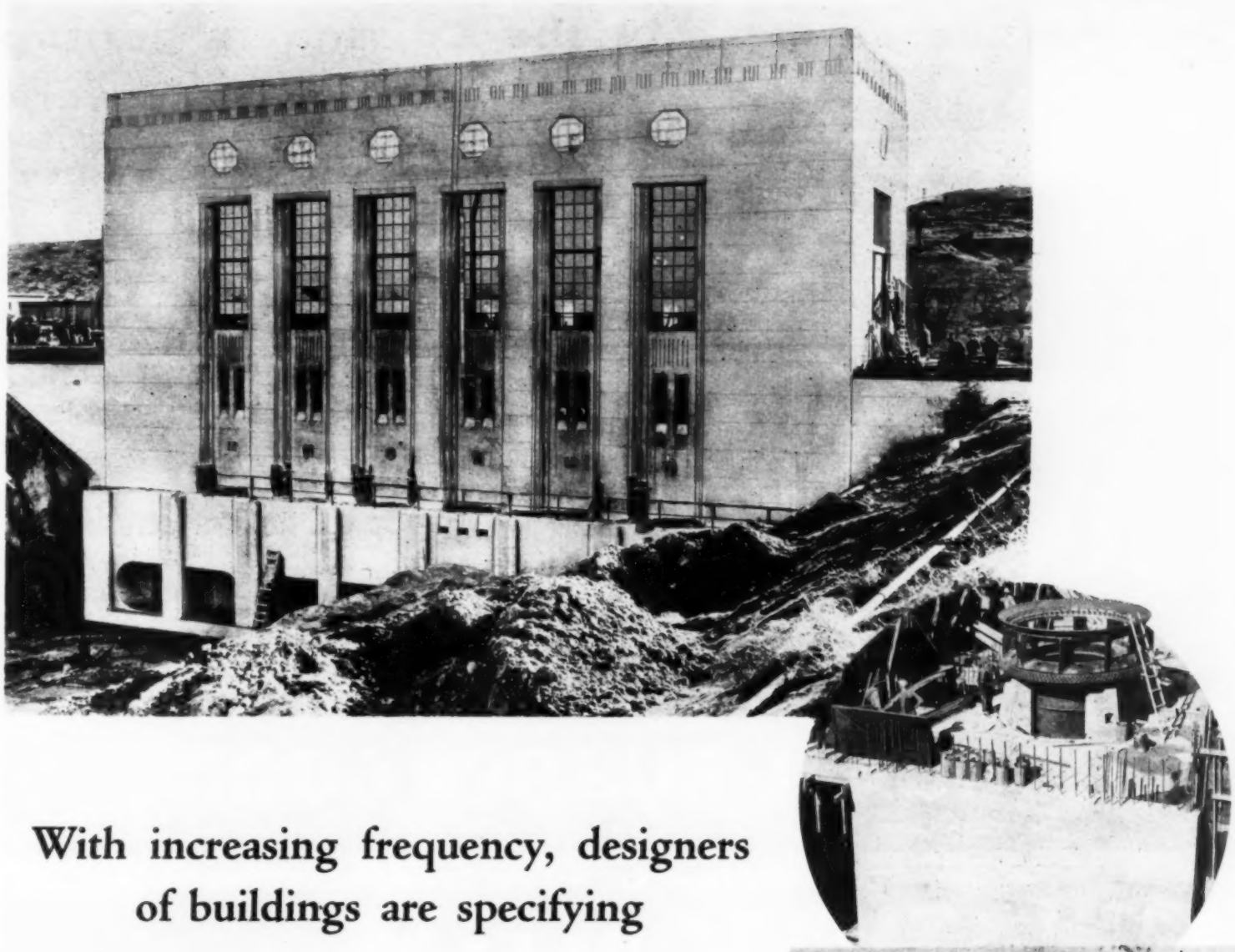
EASY DUMPING

ONE MAN WHEELS AND UNLOADS TWICE AS MUCH!

Actual dynamometer tests prove that it takes only *half the force* to move the C M C DUMPOVER that it does the ordinary cart with steel wheels. IN DUMPING THIS NEW C M C CART very little effort is required. Exclusive chassis construction with perfectly balanced tray enables operator to unload cart *completely* without lifting wheels and chassis. No hoeing, shoveling or bumping necessary.

Three convenient sizes 6½ cu. ft., 9 cu. ft., and 11 cu. ft. Write for bulletin telling the complete story of these new carts.

CONSTRUCTION MACHINERY CO.
Waterloo, Iowa



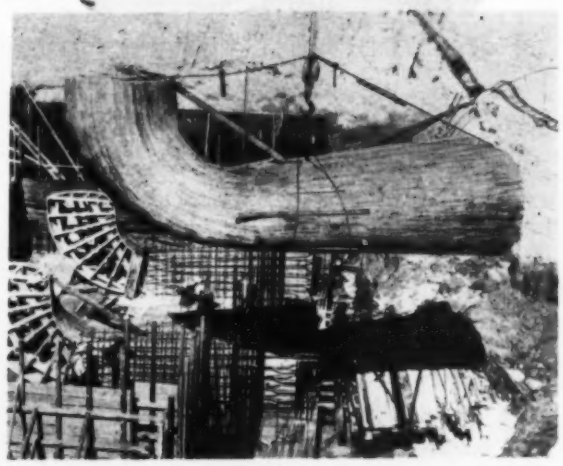
With increasing frequency, designers of buildings are specifying

ARCHITECTURAL CONCRETE

Architectural Concrete construction is today's fastest growing method of building factories, schools, churches and apartments. Walls, frame, floors and ornament are cast together of one material — resulting in beauty and fire-safety at welcome low cost.

Financiers, corporation presidents and other business and community leaders are being reached through national advertising, and know the advantages of Architectural Concrete. They'll want their new structures figured in concrete.

Be ready to base your bid on the latest construction technique. You will find the facts in our Information Sheets and in *"Forms for Architectural Concrete,"* which discuss equipment, methods, details and materials.



Power plant for the $10,000,000 PWA Sutherland Project utilizing the waters of the North Platte River for irrigation and power. Located south of North Platte, Neb. Project carried out by the Platte River Valley Public Power and Irrigation District. Donald D. Price, chief engineer and general manager. Parsons, Klapp, Brinckerhoff and Douglas, consulting engineers.

PORTLAND CEMENT ASSOCIATION
Dept. A6-16, 33 W. Grand Ave., Chicago, Ill.

Please send literature checked:

☐ *Forms for Architectural Concrete*

☐ Information Sheets on specifications and other details (AC series, 1 to 12)

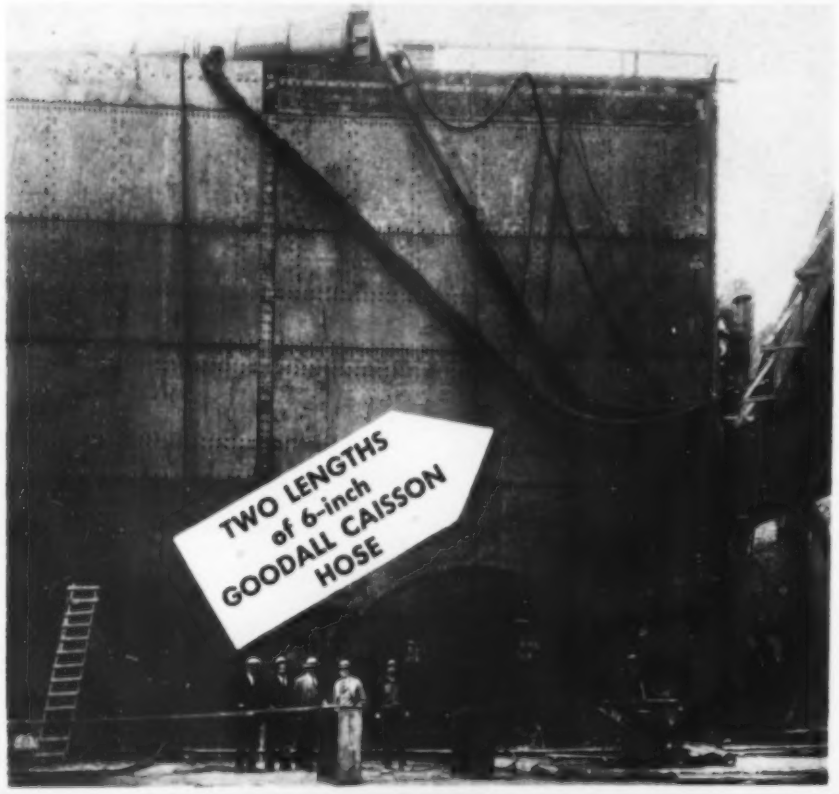
Name .....

Company .....

Address .....

City ..... State .....

The men are posing—but the Caisson is getting ready to go to work



Once put into service this Caisson must continue without interruption until the job is finished. The Hose is 6"

GOODALL CAISSON HOSE

Selected because the contractor knew it was exactly what the service required.

The GOODALL LINE is complete with items built to do a definite service on every job—better.

Ask our nearest branch for a "Standard of Quality" folder.

GOODALL RUBBER COMPANY
PHILADELPHIA, PA.
New York • Pittsburgh • Chicago • Cleveland • Houston
Mills at Trenton, N. J.

MECHANICAL PRODUCTS CORP.
510-514 East Fourth St., Los Angeles, Calif.
San Francisco • Seattle
Distributors in the principal cities

GOODALL RUBBER GOODS

The originators of the "Standard of Quality" Line (Reg. U. S. Pat. Off.) of contractor's rubber goods.

BLAW-KNOX

Aids Construction

TO FULFILL CONTRACTS SPEEDILY AND PROFITABLY

New developments and improvements in Blaw-Knox Construction Equipment are right in step with today's program.

With a background of years of practical experience, Blaw-Knox equipment is trustworthy. It is economical and low in maintenance. Designed to stand up under severe operating conditions, it is fitted to the job by skilled engineers. It helps immeasurably to fulfill contracts speedily and profitably.

BLAW-KNOX CO., 2086 Farmers Bank Bldg., Pittsburgh, Pa.
Offices and Representatives in Principal Cities

WELL BALANCED

Sterling trays are made of a single sheet of steel, folded in shape by a hydraulic press. Corners are lapped giving extra strength at these points. Trays are welded—not riveted. As many more welds are used in this construction than rivets in a riveted tray, the tray is not only stronger but the shape is maintained when the tray receives hard service.

In place of the usual 5/16" rod rolled in top edge of tray, a rod 11/32" in diameter is used in Sterling trays. This increase in size adds 21% to the strength of the rod, and in addition, the rod is butt-welded at the joint, making a CONTINUOUS, one piece reinforcement at top of tray. V-shaped front tray braces, connected at the top by a 1/4" x 1 1/2" brace support, gives extra strength to the front of trays.

IT IS NOT A STERLING WITHOUT THE S

S STERLING WHEELBARROW CO. S

900 SOUTH 71ST STREET

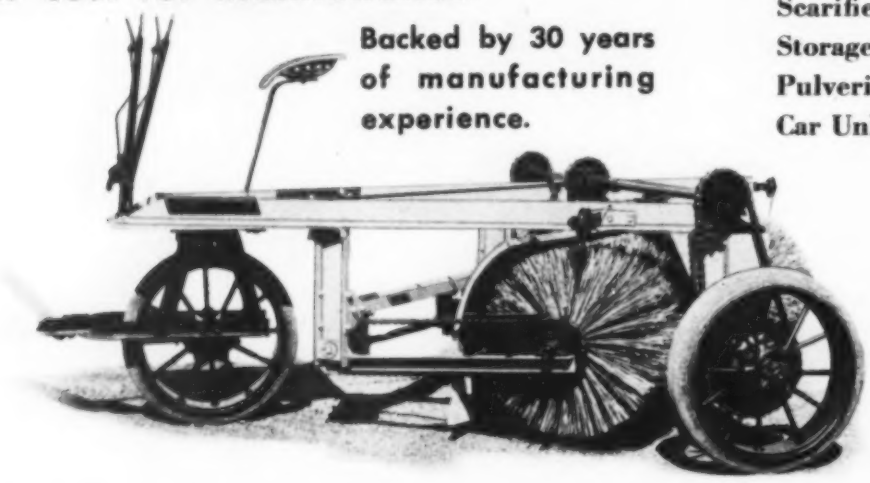
MILWAUKEE • WISCONSIN, U.S.A.

DON'T BE DECEIVED BY LOW PRICES

Low prices usually mean a cheaper inefficient product.

RELIANCE EQUIPMENT is of heavy design, built to give efficient SERVICE over a long period of years with exceptionally low cost for maintenance.

Backed by 30 years of manufacturing experience.



Reliance 3 Wheel Rubber Tired Sweeper
Designed especially for preparing highways for resurfacing

WE OFFER A COMPLETE LINE OF

Rock Crushers	Chip Spreaders
Bucket Elevators	Heating Kettles
Revolving Screens	Bin Gates
Scarifiers	Feeders
Storage Bins	Belt Conveyors
Pulverizers	Grizzlies
Car Unloaders	Air Separators

Sand & Gravel Spreaders
Wash Boxes

Write for catalog and prices.

UNIVERSAL ROAD MACHINERY CO.

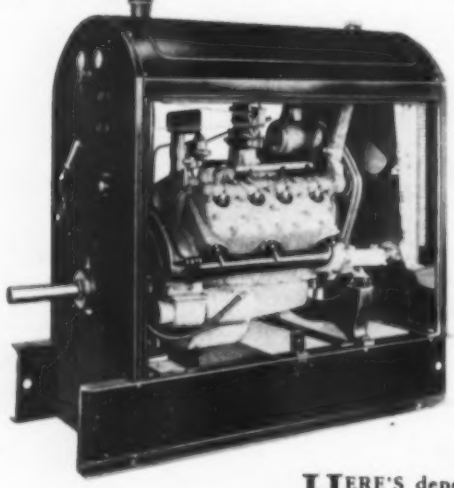
KINGSTON N. Y.

New York Office 114 Liberty Street

LOW COST POWER

with this

KRW FORD V-8 UNIT



HERE'S dependable, low-cost power up to 60 H. P. — complete, compact, portable. Ideal for welders, compressors, hoists, pumps, well drilling outfits and other contractors' equipment.

Assembled with brand new heavy duty Ford V-8 Truck engine. Large capacity radiator protected by heavy screen. Engine rubber mounted — outfit complete with governor gas tank, 17 plate battery, instruments and louvered side panels to thoroughly enclose the engine.

WRITE for complete information, price, and data showing how this unit will *pay for itself out of savings* in a few weeks, whether operated on gasoline or natural gas. You can buy thru your Ford Dealer and benefit by local service and low-cost Ford engine replacement feature.

Also K R W ELECTRIC PLANTS

20 KW outfit with dual voltage take-off for handling *both* light and power requirements simultaneously.

K. R. WILSON 15 Lock St. BUFFALO, N.Y.

EXCLUSIVE BUILDER OF APPROVED FORD SHOP EQUIPMENT SINCE 1916

QUALITY— and EQUIPMENT

No matter what your needs are, from the smallest Clyde Hoist to the huge Clyde Whirleys, there is assurance for you in knowing that every unit in the entire Clyde line is built to the highest standards of quality, both in workmanship and materials. The enviable reputation of Clyde Quality Equipment is proven by constant repeat orders and letters of recommendation from more-than-satisfied owners.

Write for our "get-acquainted" Bulletin J-1. It contains a brief summary of the complete Clyde line.

A Clyde Whirley handling rock on harbor work, Tampico, Mexico.

CLYDE SALES CO.

DULUTH, MINN.

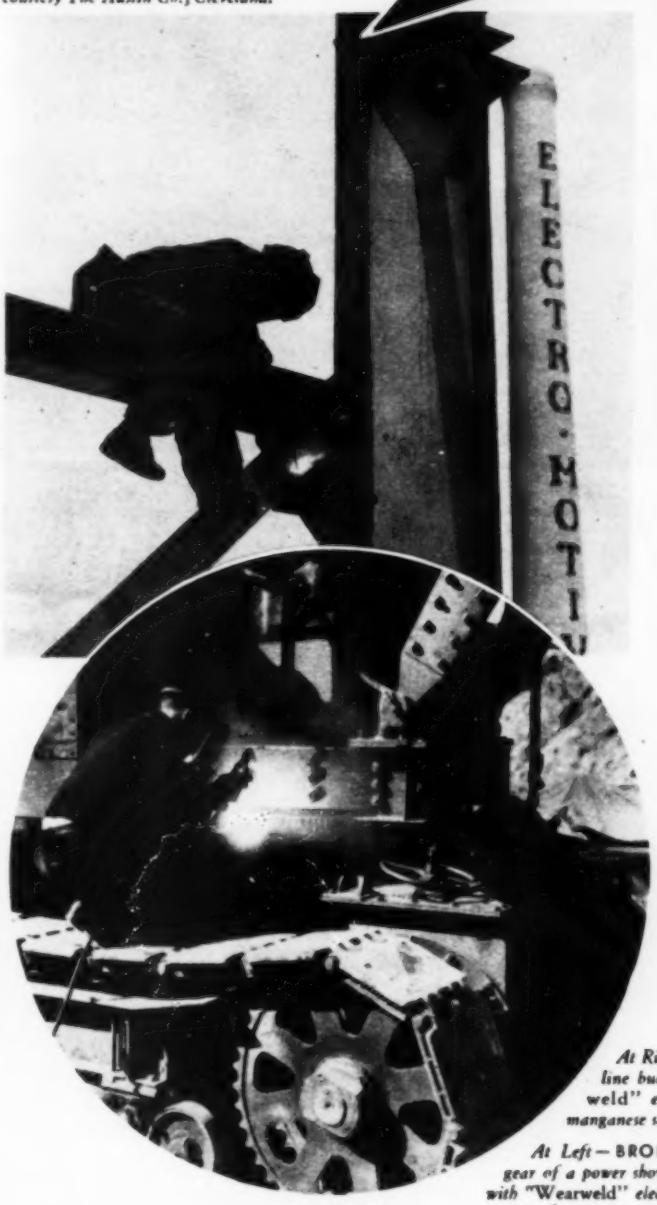
BATTLE-DECK FLOOR *for the Tri-Borough Bridge, New York City, built from silicon steel plates, contains 4500 feet of welds made with* "Shield-Arc 85" *electrodes.*

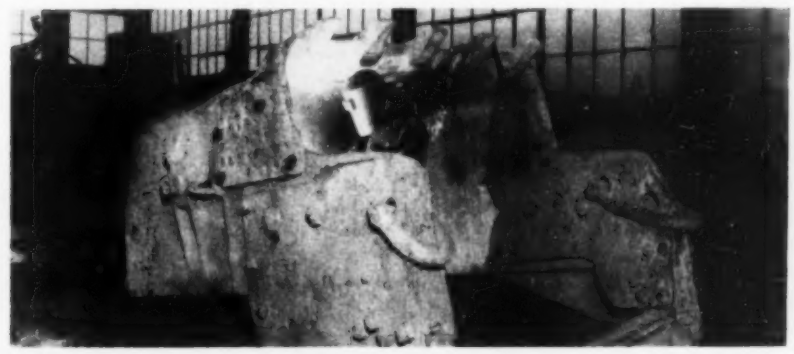
STEEL ERECTION *and fabrication for the new 2000-ton structure of the Electro-Motive Corp. were speeded with "Fleetweld" electrodes and* "Shield-Arc" *welders. Photo courtesy The Austin Co., Cleveland.*

YOU'RE SURE OF THE PACE WHEN "SHIELD-ARC" IS ON THE JOB

We've heard hundreds of contractors and engineers remark that their *"Shield-Arc"* welder is the most valuable tool on the job. And no wonder! What other machine can make profits as a construction tool . . . and, at the same time, be handy to put a new lip on a cement mixer, hard-face a worn pump impeller or do 101 odd jobs that avoid costly delays in the schedule?

The Lincoln man nearby will tell you more about this "insurance for construction profits." If you are interested in "Studies in Design for Structural Welding" or "Hard-facing Procedure," two free arc welding bulletins, just mail the coupon. THE LINCOLN ELECTRIC COMPANY, Dept. G-259, Cleveland, Ohio. Largest Manufacturers of Arc Welding Equipment in the World.





At Right—NEW LINING *for a dragline bucket, welded in with* "Manganweld" *electrode—the ideal rod for manganese steel.*

At Left—BROKEN TOOTH *on the bull gear of a power shovel. A new one was built-up with* "Wearweld" *electrode.*

"SHIELD-ARC"

THE ONLY *complete* WELDER

THE LINCOLN ELECTRIC CO.
Dept. G-259, Cleveland, Ohio

Please send me a free copy of ☐ Studies in Design for Structural Welding ☐ Hard-facing Procedure.

Firm .....

Name .....

Position .....

Address .....

City .....

State .....

20 TO 50% MORE YARDAGE *with* PAGE AUTOMATICS

One user says:
"Since putting on your AUTOMATIC we are stripping at least 50% more material." *

Another reports:
"I have three operators—they all claim the AUTOMATIC is the best, by far, of any bucket they ever used." *

A third states:
"We have dug up rock almost as large as the bucket. We have increased our yardage more than double." *

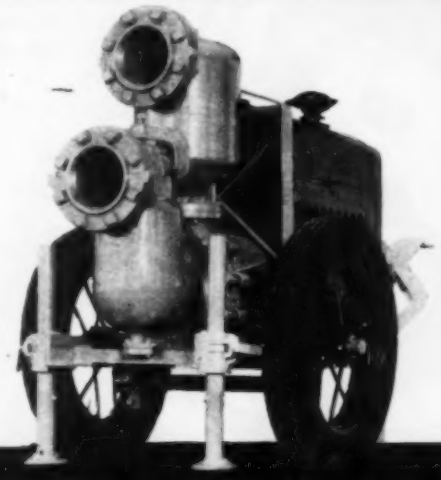
With such facts, can you afford to use any other dragline bucket? Learn about the AUTOMATIC now! See your dealer or write us direct. Free bulletin on "The AUTOMATIC" sent on request. Address Dept. "S"

* Excerpts from letters in our files.

BUILT IN SIZES 3/8 to 15 CUBIC YARDS

"... DIG WITH A PAGE AUTOMATIC"

PAGE ENGINEERING COMPANY
CLEARING POST OFFICE CHICAGO, ILLINOIS

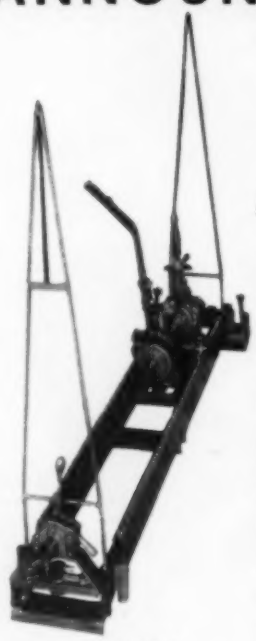


LABOUR PUMPS

Husky strength and maximum simplicity—only one moving part—combine to make LaBour Pumps dependable as the day is long. They're always on the job—which means fewer grey hairs in your head and more dollars in your pocket. Write for complete details.

THE LABOUR COMPANY, INC.
1300 Sterling Avenue
ELKHART, IND

★ANNOUNCING a NEW HIGH POWER HORIZONTAL BORING MACHINE



PATENTED

Easier to operate than ever

This compact, high-speed Hydrauger model has been developed from many years' experience in building horizontal boring machines. It embodies features of the larger sized Hydraugers plus other important refinements.

It is a high-power, medium priced unit for rapid boring of horizontal holes up to 14½" in diameter.

Important advantages are: greater ease of setting-up and boring; straighter boring; lowest cost and fastest installation of underground piping; and minimum investment.

Hydrauger units are indispensable when installing wrapped or coated pipes. They have been widely used to prevent pavement cutting, ditching, traffic interruption, and destruction of lawns or gardens when installing horizontal piping. Installation costs are often reduced 90%. In many instances where pavement cutting permits were refused the Hydrauger was the only possible solution. Invariably a Hydrauger will pay for itself within one year, and often on a single job.

Ask for full details of the new Hydrauger Model 2A-2X.

HYDRAUGER CORPORATION, Ltd.
116 New Montgomery Street, San Francisco

FEATURES

5-horsepower airmotor gives 50% faster boring.

New 4' 8" boring bar sections easier to handle.

Bores holes 2½" to 14½".

Extra strong hi-tensile alloy boring bar joints.

New shaped cutters both cut and undercut at the same time for faster boring.

Short, rigid frame requires less ditching for setting-up.

Higher speed boring insures greater accuracy.

HYDRAUGER
"The Mechanical Gopher"

HAULS 600 TONS DAILY

Truck being loaded at mine of Industrial Coal and Iron Co. in Southern Ohio

COAL MINE TRUCK CARRIES 31-TON LOADS . . . NEVER TOUCHES PAVEMENT—TIRES TAKE IT

Six hundred tons of coal hauled is just a day's work for one of these big trucks. Five such semi-trailer units are constantly on the go. They're loaded in a hurry by big, powerful electric shovels. Then, after leaving the stripping operation, they drive through mud and water—over stones. They never see a paved road. And the gross load is over 31 tons. What a job for tires!

Tires Triple Protected

Yet Triple Protected Silvertowns take the trucks through with never a let-down. Not one sidewall break is chalked up against them in over a year!

It's that kind of service that leads truckers to choose Triple Protected Silvertowns for their toughest hauling jobs. And if they stand up under the brutal, grinding service of a strip mine, they'll save money on your trucks, too.

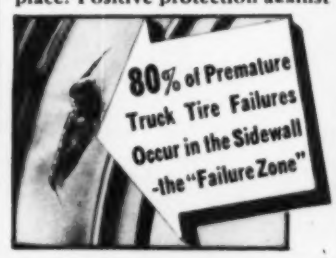
Here's the secret of Goodrich performance. Every Silvertown is built with a new invention in the sidewall. This development—Triple Protection—provides a 3-way safeguard against sidewall breaks—the cause of 80% of premature failures! When you get this protection, you've gone a long way toward getting tire costs down to bed rock. Don't take chances. Insist on Triple Protection when you buy. It costs you *nothing extra.*

HOW TRIPLE PROTECTION WORKS

1 PLYFLEX—a *new*, tough, sturdy rubber material with greater resistance to stretch. A layer of Plyflex in the sidewall prevents ply separation—distributes stresses—checks local weakness.

2 PLY-LOCK—the new Goodrich way of *locking* the plies about the bead. Anchoring them in place. Positive protection against the short plies tearing loose above the bead.

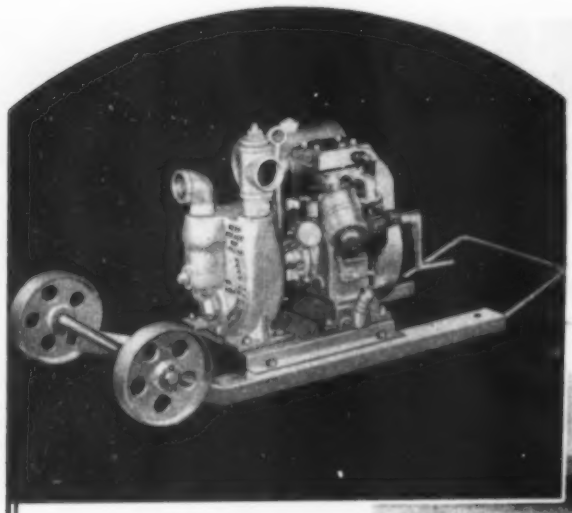
3 100% FULL-FLOATING CORD—Each cord is surrounded by rubber. With ordinary cross-woven fabric, when the cords touch each other, they rub—get hot—break. In Silvertowns, there are no cross cords. No friction.



© 1936, The B. F. Goodrich Co., Akron, Ohio.

Goodrich *Triple Protected* Silvertowns

SPECIFY THESE NEW SILVERTOWN TIRES FOR TRUCKS AND BUSES



REPEAT ORDERS prove conclusively that Sterling Pumps give Sterling Service

Sinclair Prairie Pipe Line Co. own sixteen Sterling Pumps.

Dependable performance, a Sterling characteristic, explains the repeat orders placed by the Sinclair Prairie Pipe Line Co.

SIMPLE DEPENDABLE RUGGED

STERLING QUALITY

A Few Other Prominent Sterling Users Who Have Placed Repeat Orders:

Pittsburg Des Moines Steel Co., W. S. Rae, Denburger Contracting Co., Bilhorn, Bower & Peters, Inc., Humphreys Gold Corp., Portland Bridge Co., W. A. Ross Construction Co.

WRITE FOR CATALOG — Send for the Big Sterling Catalog and bulletin of engineering data today. It's free for the asking.

Sterling
MACHINERY CORPORATION
411-13 Southwest Blvd. Kansas City, Mo.

Large Capacity and Portability

are combined in H&B Tower Type

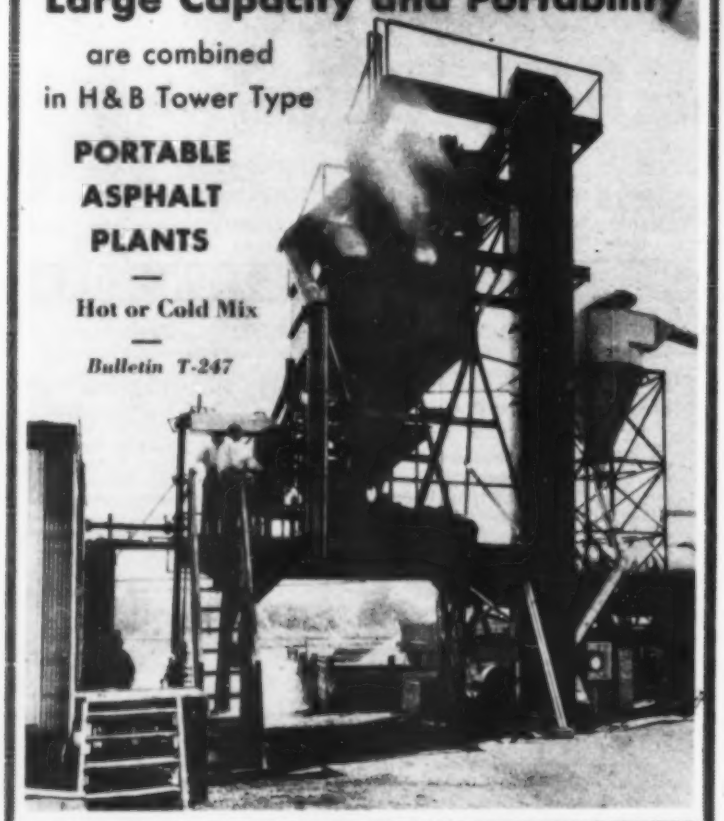
PORTABLE ASPHALT PLANTS

—

Hot or Cold Mix

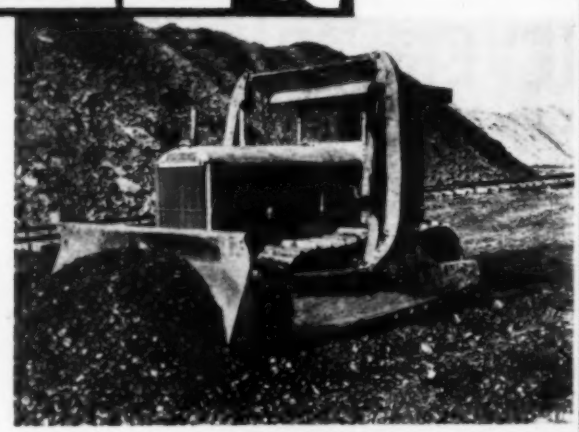
—

Bulletin T-247



HETHERINGTON & BERNER, Inc.
INDIANAPOLIS, INDIANA
Builders of Asphalt Paving Machinery for over thirty years

BAKER



INSIST ON ALL OF THESE FEATURES

Simple Construction
Direct Blade Lift
Accurate Control
Great Strength
Correct Mounting
Few Wearing Parts
Lower Repair Costs
High Blade Lift

Ask For Bulldozer Bulletins.

OTHER BAKER PRODUCTS

Road Rooters
Tractor Scrapers
Road Discs
Disc Attachments
Snow Plows

THE BAKER MFG. CO.
568 Stanford Avenue,
Springfield, Ill.

BULLDOZERS

MORE Profitable Performance

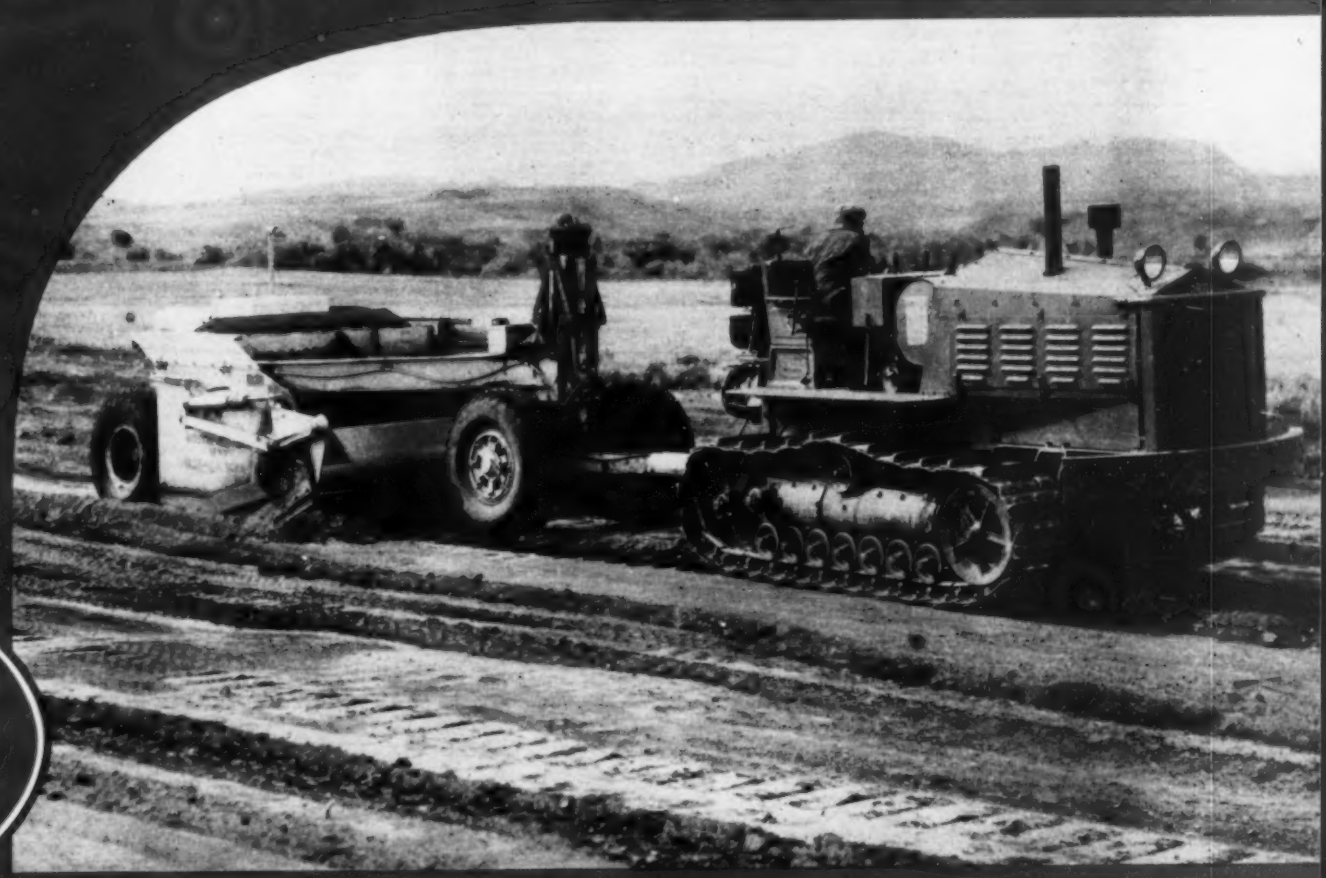
• All over the country Cletracs are establishing enviable performance records for high yardage at low cost.

The Cletrac 80 shown, for example, hauling a 12-yard, self-loading scraper, working in sandy loam averaged for the job, 120 yards per hour on a 600-foot haul. The average cut was 15 feet deep and the completed fill was 20 feet deep. The return grades were approximately 27 degrees.

Cletrac controlled differential steering, an exclusive feature, is also an important factor in Cletrac performance, saving time on turns and adding greatly to the maneuverability of tractor and equipment, loaded or empty.

All Cletrac Diesels have 6 cylinders and are standard equipped with electric starting. Six-cylinder engines mean smooth-flowing, flexible power.

• Before you buy another crawler tractor, compare Cletrac prices, power and equipment.



Cletrac
Crawler Tractors
Built To Endure
REG. U.S. PAT. OFF.

THE CLEVELAND TRACTOR COMPANY
CLEVELAND, OHIO

RANSOME Pioneers New Paving Method---

ARE YOU USING THE RANSOME DUAL DRUM PAVER?

We have been telling you that the Ransome Dual Drum Paver can increase yardage laid by at least 50% and, in many cases, by 75%, besides cutting overall costs. These Ransome Pavers have been proving our claims on job after job.

For example, the York Engineering & Construction Co., on their 12-mile section of Route 8 in Pennsylvania, were able to finish their contract 42 days *ahead* of specified time, using only *one* Ransome Dual Drum Paver. Yet when the State sent out requests for bids, they specified the use of three pavers on the job to make sure it would be finished the same year.

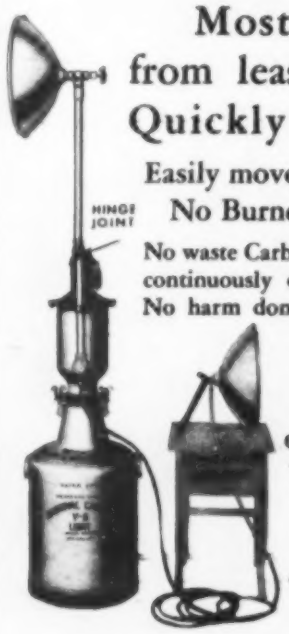
Let us send one of our men to explain in detail why the Ransome Dual Drum Paver speeds up production and how it will fit in on the particular work you have ahead.

RANSOME CONCRETE MACHINERY COMPANY
DUNELLEN, NEW JERSEY
Agents in All Principal Cities
Cable Address: "Racomaco" Dunellen

NATIONAL CARBIDE
V-G LIGHTS

Most Light
from least Carbide
Quickly Charged

Easily moved—No wires
No Burner Troubles



No waste Carbide whether used continuously or intermittently
No harm done if tipped over

Extension to X-100 DOUBLES THE CANDLE POWER *fastens anywhere*

Always use NATIONAL CARBIDE *"In the Red Drum"* Distributors Coast to Coast

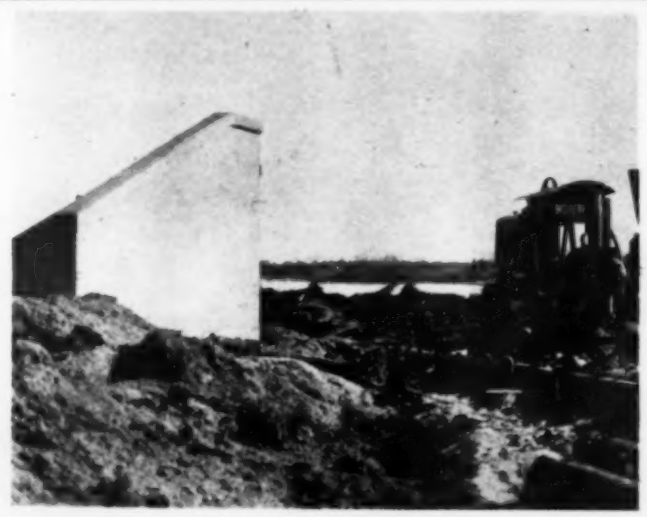
WRITE FOR COMPLETE INFORMATION

Y199
NATIONAL CARBIDE V-G HANDY LIGHT
Burns about 5½ hours on 1¾ lbs. of 14-ND Carbide, 2 gals. water; delivers about 1500 c.p. Weighs 37 lbs. charged—easy to carry, handy in emergencies.

X-100
NATIONAL CARBIDE V-G LIGHT
About 8,000 c.p. for 12 hours on 7 lb. charge of National Carbide. Easily handled by one man. Weight 55 lbs. empty; 98 lbs. full.

WL1-C1
NATIONAL CARBIDE LANTERN
Burns 8 hrs. on 8 oz. of Carbide. Brilliant rear signal of red, blue or green, no extra charge . . . Ideal for emergency lighting on road at night.

NATIONAL CARBIDE SALES CORP.
LINCOLN BUILDING
Opposite Grand Central, NEW YORK



At high tide this site was covered with water. By constructing an embankment, and installing a Moretrench Wellpoint System, the contractor was able to slope the excavation and drive his piles in the dry—*fourteen feet below high tide.* No sheeting was necessary. In two weeks the foundation was finished. His reaction was this:

"THE MORETRENCH WELLPOINT SYSTEM WORKS 100%."

MORETRENCH CORPORATION
Sales Office: 90 West St., New York Works: Rockaway, N. J.

power
for every transportation need

Here are pictured the "hearts" of the great GMC truck line—ten great engines graduated in size and in power-ability to exactly meet the demands of modern transportation. Each power plant is correctly engineered for a specific capacity range to the end that truck owners—be they operators of vast fleets or of only one delivery vehicle—may look with confidence to GMC, *commercial vehicle headquarters*, for the kind of hauling equipment that assures maximum work and earnings. *GMC prices start at $425, chassis f.o.b. Pontiac. In every capacity range there is an unmatched value.*

GMC THE TRUCK OF VALUE ½ TO 15 TONS

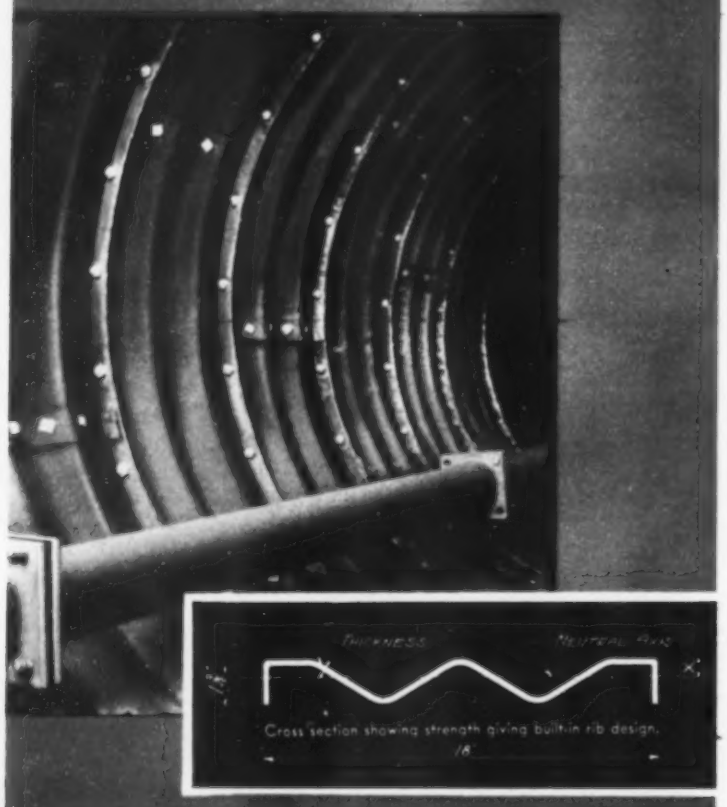
Time payments available through our own Y. M. A. C. 6% plan.

General Motors Trucks and Trailers

GENERAL MOTORS TRUCK COMPANY • PONTIAC, MICHIGAN

The Rib's in the Plate

for strength and economy



Cross section showing strength giving built-in rib design.

Armco Steel Plate Lining in tunnel. Note these points: Bolted assembly; built-in rib design; ends of sections overlap; no weak joints, strengthening corrugations run full length; uniform plate sections easily adapted to any type construction; absence of I-beams or other structural reinforcements.

• The built-in rib design of Armco Structural Steel Plate Lining gives you ample strength and cuts costs. Use it for all sorts of underground construction work.

On a pound-for-pound basis it is the strongest plate. Its balanced design reduces first cost by providing greater strength with much less weight. For the same reason labor expense is lower because of speedy handling and ease of installation.

Less excavation is another big advantage of using Armco Steel Plate Lining. You get better line and grade and strict adherence to specifications. Plate sections are interchangeable and come fitted, ready for installation. With the built-in rib design of Armco Steel Plate Lining there are but few jobs that require structural reinforcement.

Write for complete information as well as definite figures on that next job. Ingot Iron Railway Products Company, 703 Curtis Street, Middletown, Ohio; Berkeley, California.

ARMCO

ARMCO
Steel Plate Linings

COFFING ADVANCED DESIGN HOISTS

LIGHT • COMPACT • POWERFUL • PORTABLE

For lifting or pulling heavy pipe, wire fences, heavy machinery, heavy cable, and hundreds of other things; Coffing hoists satisfy the users by their quick response to meet every demand, their great power, their remarkable economy in time and labor saving, their low maintenance cost, and their extremely long life.

Built from ¾ to 6 tons capacity, weighing 14 to 65 lbs.

COFFING HOIST COMPANY
DANVILLE • ILLINOIS

JAEGER "SURE PRIME" PUMPS

Fastest 100% Automatic Prime — Greater Efficiency at Any Lift

New Catalog and Prices Will Tell You Why Jaeger Pumps Outsell All Others — Write for It.

THE JAEGER MACHINE CO.
800 Dublin Ave., Columbus, Ohio

Two More Chiefs
go to Washington

On Behalf of More and Better Roads

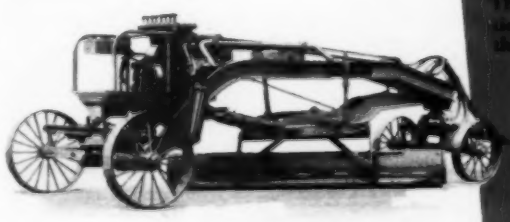
The State of Washington is a far cry from Ohio but these two Galion "Chief" Road Rollers are right in their element . . . giving their best . . . improving highways so that you can get closer to nature.

That's one thing about Galion Road Machinery . . . it doesn't matter what County, what State or what Country . . . you'll usually find a Galion Unit on the job . . . serving efficiently and economically.

Galion has a corps of specialists who have been designing and building Road Machinery for years. They know how to select the best Unit for your particular job. The comprehensive Galion line provides them the widest selection.

Let us send you literature on Galion Motor Graders, Rollers, Pull Type Graders, Planers, Maintainers, Drags, Spreaders and Scrapers.

Galion Leaning Wheel Grader with Hydraulic Control. Also Manually operated Graders.



Galion Motor Patrol Grader with Case L I Power and Hydraulic Control. Double Drive, Power and wheel equipment optional.

THE GALION IRON WORKS & MFG. CO.

DISTRIBUTORS — GALION, OHIO — EVERYWHERE

THE SHOVEL THAT BUILT AMERICA

Genuine O. AMES

First manufactured in 1774, Genuine O. Ames shovels are still the leading Plain Backs.

The famous Ames Bend, often copied but never equalled, gives to this pioneer shovel, a perfect balance—and that means greater shoveling ease.

Electric welded straps assure a permanent, not a temporary connection—Armor-D handles—Label die embossed—all exclusive "Ames" features.

Time-tested Special Alloy Steel gives longer wear.

ASK YOUR JOBBER

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3-STAR
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SINCE 1774

AMES BALDWIN WYOMING CO.
PARKERSBURG, W. VA. NORTH EASTON, MASS.

Sika

WATERPROOFING

Use SIKA to stop leakage through structurally sound sub-grade masonry — dams, retaining walls, filter beds, tunnels, manholes, walls, floors, etc. SIKA mixed with portland cement is easily applied by hand and will successfully seal off infiltration from inside even under pressure.

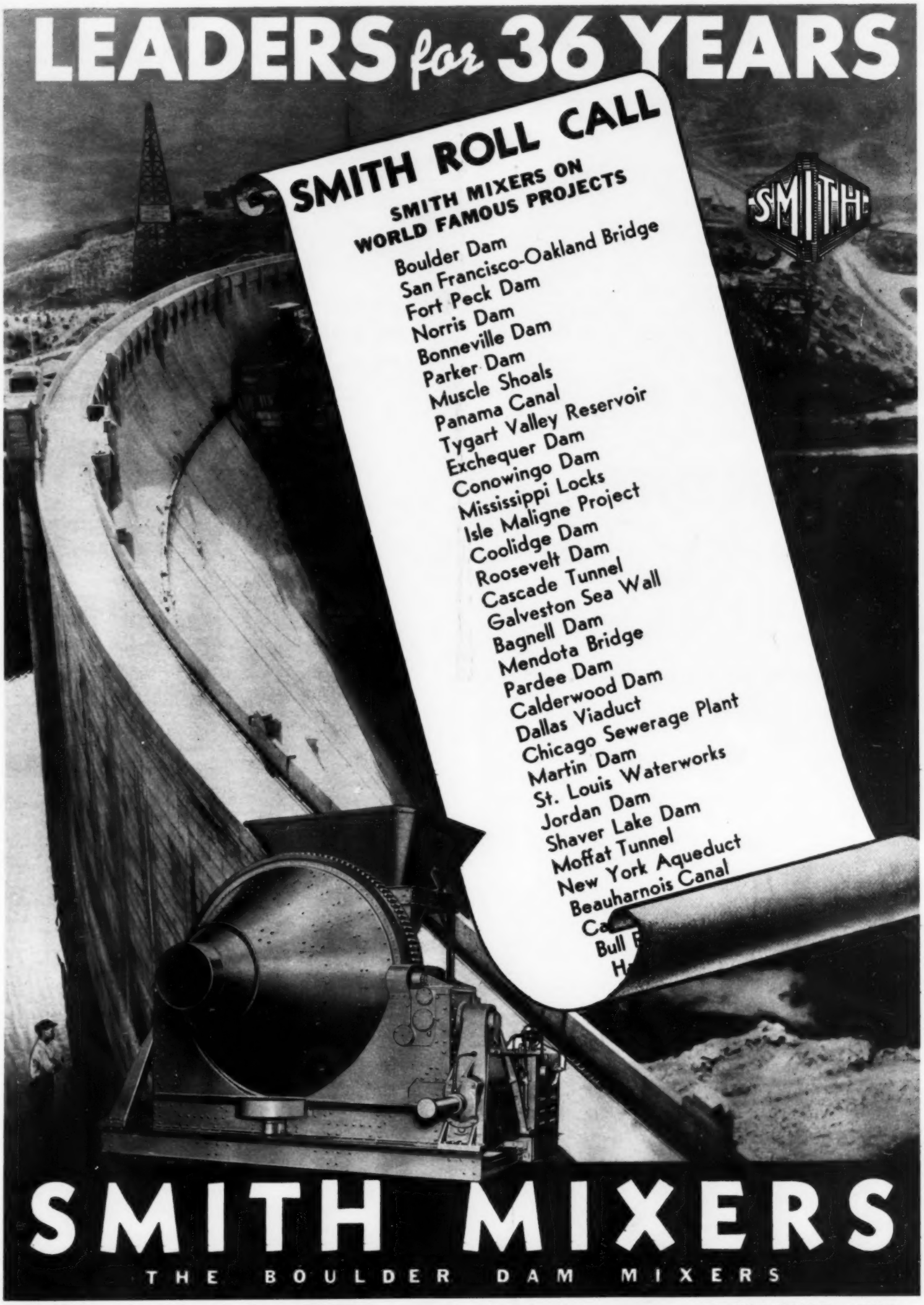
Write us about your waterproofing problems.

SIKA, Inc.
1943 Grand Central Terminal, New York, N. Y.

Reputation —

"In this day of business resumption and rebuilding, no one value deserves more earnest or immediate consideration than that of reputation. Without it every manufacturer's plant is but a pile of building materials and his product but a more or less interesting toy."

LEADERS for 36 YEARS



SMITH MIXERS

THE BOULDER DAM MIXERS

THE T. L. SMITH COMPANY • 2851 N. 32nd Street • MILWAUKEE, WIS.

It's Faster!

Attention, you fellows who turn nuts! BETTER and STRONGER METAL plus a special design of handles, heads and pawls has made your "Favorite" wrench a better and stronger tool for faster work.

The new model "FAVORITE" Reversible Ratchet WRENCH

stronger and better

This is *in addition* to the principle that has made this wrench famous in the field — the famous nut-tightening back-and-forth *streamline ratchet motion* and the fact that the wrench *never leaves the nut* until the nut is tight. Speedy nut turning is one reason why the "FAVORITE" is used on large and small jobs from Maine to California.

See the coupon below? It's a big help in quickly getting all the facts on this NEW and BETTER "FAVORITE" . . . facts that will help you cut costs and speed work on the next nut job. Send that coupon in now!

Greene, Tweed & Co.
Sole Manufacturers
109 DUANE ST., NEW YORK

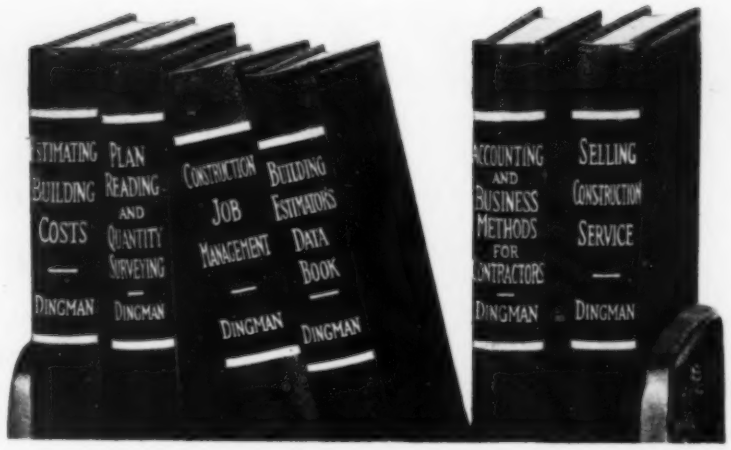
Want facts? Just clip and mail.

GREENE, TWEED & CO.
109 Duane St., New York City

I want to know more about the new and stronger "Favorite" Reversible Ratchet Wrench. Send me full details today. I want to turn nuts — Bolt size
.....Sq. .....Hex.

Name .....

Address .....



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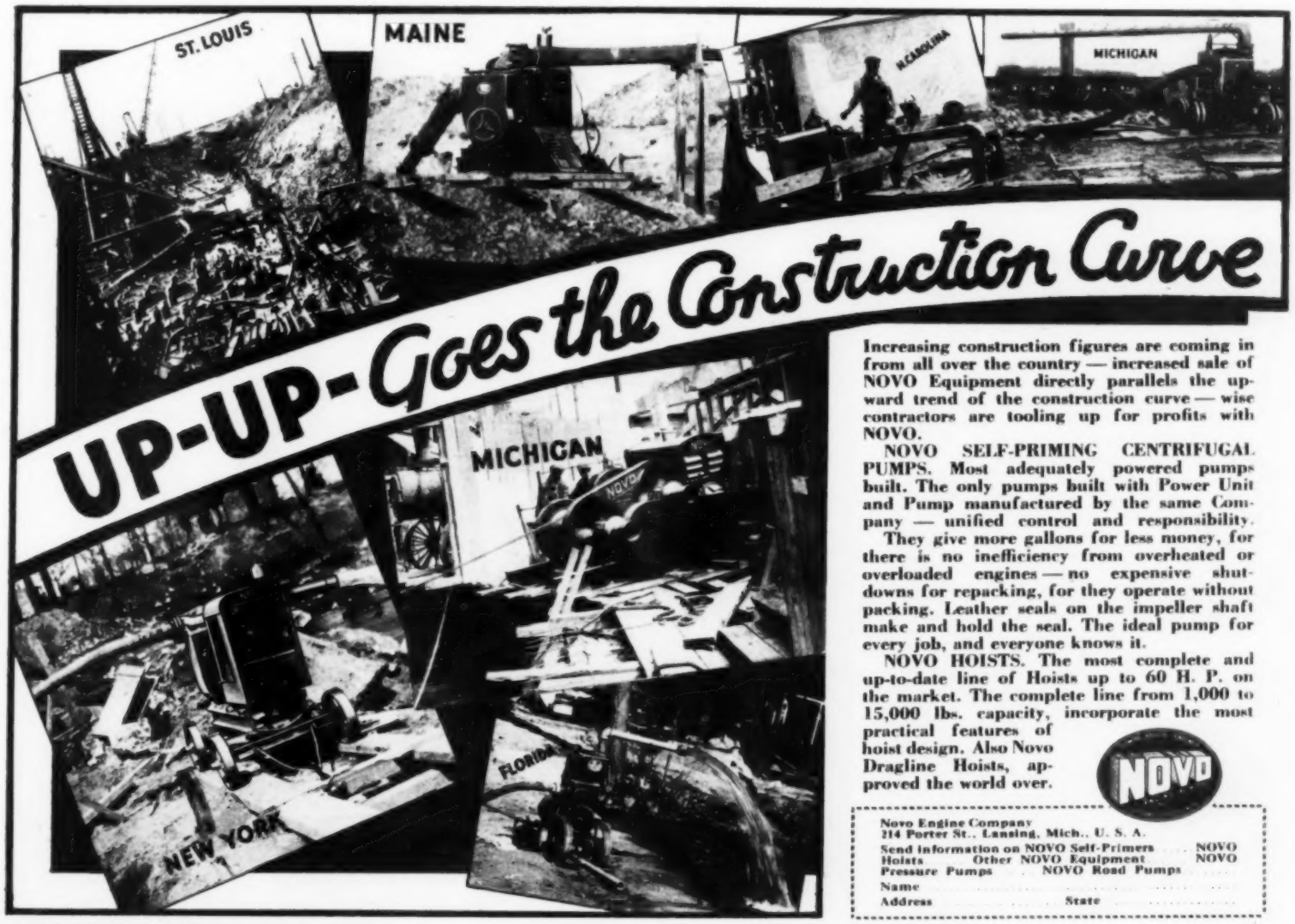

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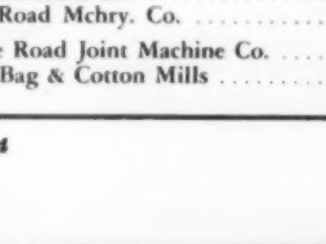

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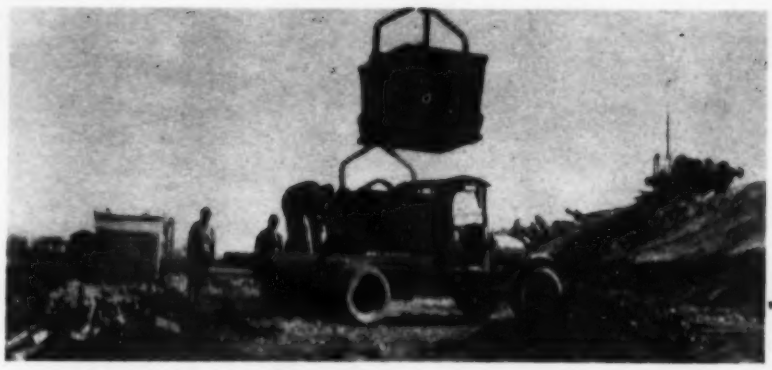


GENERALS HELP MAKE MISSISSIPPI NAVIGABLE

Spencer, White and Prentis, Inc. of New York City, are constructing a nine-foot channel for the U. S. Government, on the Mississippi River in Northern Minnesota, to make it commercially navigable. A large fleet of tractor-trucks are being used in the work and all are equipped with General Traction-tread Tires, because of their superiority in providing traction over rough, soft going. Photo by courtesy of W. L. Schultz, of the War Dept., U. S. Engineers Corp.

25 YARDS OF BULK CONCRETE!

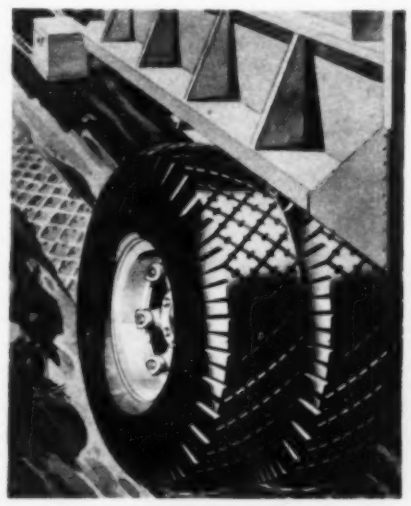
This truck carries the largest Diesel engine made for trucks—and the body holds 25 yards of bulk concrete. Triangle Rock and Gravel Company are using it in the construction of new water supplies for the City of Los Angeles. The construction job will use almost twice as much concrete as Boulder Dam. Triangle can't afford to have this job held up with tire trouble, so they put on 18 Generals.

THEY GIVE THE TOUGH JOBS to Generals · · everywhere

FIND A JOB that's hard on tires—and you'll usually find Generals. That's because Generals have proved that they can "take it" where other tires fail.

If *your* job is tough there is a General Tire that will do it better at lower cost. Dependable Generals are proving this statement to skeptical "show me" operators every day.

Your General Tire dealer has a complete, highly specialized line of truck tires. He is a practical truck tire man with wide experience and accurate knowledge in fitting the right type and size of tire to every kind of job. This combination is worth real money to you. Call him in.



THE GENERAL HEAVY DUTY TRACTION BALLOON is made to order for the toughest construction jobs. It is only one of the complete line of Generals—each designed and built specifically to do a certain job better.

3 Reasons Why Generals Are More Profitable to You:

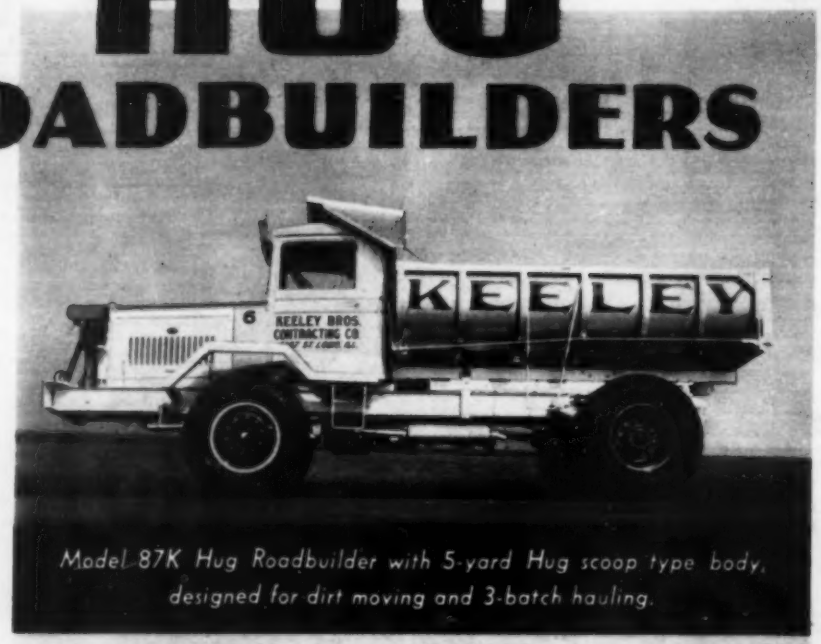
1. Generals are stronger tires—additional full-width plies of powerful cord are anchored bead to bead—with no "idle" plies—no floating breaker-strips.
2. Generals are cooler tires—they flex uniformly without that heat-producing "hinging action" of ordinary breaker-strip tires.
3. Generals have "compact rubber" treads—their construction keeps the tread rubber compact and compressed so that it wears slowly and gives more miles.

FREE

Read this booklet on how to avoid the more expensive tire troubles. Write to The General Tire and Rubber Company, Akron, Ohio. In Canada—The General Tire and Rubber Company of Canada, Limited, Toronto, Ont.

GENERAL TRUCK TIRES

3 Pace-Setting HUG ROADBUILDERS



Model 87K Hug Roadbuilder with 5-yard Hug scoop type body, designed for dirt moving and 3-batch hauling.

Model 97L Hug Roadbuilder with 8-yard Hug rock type body, for dirt and quarry operations.

Model 87Q Hug Roadbuilder equipped with 6-yard Hug scoop type body and especially designed for dirt and rock moving.

● Whether your hauling requirements call for batch hauling, dirt moving, or quarry operations, there is a Hug Roadbuilder built to meet your particular requirements.

The Model 87K for batch hauling

The Model 97L for dirt and quarry operations

The Model 87Q for dirt and rock moving

These Hug models are typical of the complete line of Hug Roadbuilders embodying outstanding features of design and construction that have made the Hug Roadbuilder famous for construction projects throughout the entire country.

Here are some reasons why Hug Roadbuilders can set a pace no other truck can meet: The Hug set-back wheel design with resulting short turning radius; the Hug front axle rocker action that eliminates thrusts and strains; the Hug multi-cushion rear spring designed especially for the Hug Roadbuilder; the Hug back-up brake which makes the long back-up easy, and the Hug electric arc welded "I" beam frame.

Other features that add to the Hug performance record are: the Buda heavy duty six-cylinder truck engine; the double reduction full floating rear axle with high traction differential; helical gear transmission with wide variation of speeds; cam and lever steering and special Hug-designed body equipment.

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574 Cypress Street
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